DOCUMENT RESUME

ED 110 635 CE 004 419

TITLE	Lithographer 3 and 2: Naval Rate Training Manual and Nonresident Career Course.
INSTITUTION	Naval Education and Training Command, Pensacola, Fla.
REPORT NO	NAVEDTRA-10452-C
PUB DATE	75
NOTE	661p.; Answer sheets not reproducible; Revised 1975
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock Number 0502-LP-052-2610 (Manual); 0502-LP-052-2611 (Answer Sheets))
EDRS PRICE	MF-$1.08 HC-$33.64 Plus Postage
DESCRIPTORS	Course Content; Employment Qualifications; *Graphic Arts; Industrial Arts; *Instructional Materials; Job Skills; *Manuals; Mechanical Equipment; Military Personnel; Military Service; *Military Training; Occupational Information; Photography; *Printing; Promotion (Occupational); Reprography; Skill Development; Technical Education; Vocational Education
IDENTIFIERS	*Lithography; Navy

ABSTRACT

The rate training manual and nonresident career course (RTM/NRCC) form is a self-study package that will enable third class and second class lithographers to fulfill the requirements for that rating. Chapter one provides a brief history of printing and discusses the duties and qualifications of the Navy lithographer. Chapters two through eighteen are composed of such course topics as job planning, cold type composition, artwork preparation, photographic equipment, photographic materials, the line negative, the halftone negative, negative corrections and stripping, platemaking, the offset press, the multilith 1250, the A. B. Dick Offset Duplicator (Model 350), the ATF 20 and 20A Presses, paper and ink, bindery equipment, letterpress printing, and shop administration. Numerous diagrams and illustrations are included throughout. The document concludes with four appendixes of additional materials: reference reading, a formulary, maintenance of lithographic equipment, and a glossary. A subject index and the assignment booklet (a component) of the Nonresident Career Course conclude the document. (BP)

ED110635

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

LITHOGRAPHER 3 & 2

JUN 12 1975

NAVAL EDUCATION AND TRAINING COMMAND

RATE TRAINING MANUAL
AND NONRESIDENT CAREER COURSE

NAVEDTRA 10452-C

PREFACE

This Rate Training Manual and Nonresident Career Course (RTM/NRCC) form a self-study package that will enable ambitious Third Class and Second Class Lithographers to help themselves fulfill the requirements of their rating. Among these requirements are the abilities to plan for the production of printed materials, including typography, reproduction of copy, and layout; operate and perform general maintenance on various types of photographic, offset, letterpress, and bindery equipments; and perform administrative functions in accordance with local command instructions and procedures and current Navy Printing and Binding Regulations.

Designed for individual study and not formal classroom instruction, the RTM provides subject matter that relates directly to the occupational qualifications of the Lithographer rating. The NRCC provides the usual way of satisfying the requirements for completing the RTM. The set of assignments in the NRCC includes learning objectives and supporting items designed to lead students through the RTM. The NRCC is designated a major revision, and retirement point credit will be granted to Naval Reservists who complete (or retake) it successfully.

LITHOGRAPHER 3&2 was prepared by the Naval Education and Training Program Development Center, Pensacola, Florida, for the Chief of Naval Education and Training. Technical assistance was provided by naval establishments and personnel cognizant of the duties of the Navy Lithographer.

Stock Ordering No.
0502-LP-052-2610

Revised 1975

Published by
NAVAL EDUCATION AND TRAINING SUPPORT COMMAND

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON, D.C.: 1975

THE UNITED STATES NAVY

GUARDIAN OF OUR COUNTRY

The United States Navy is responsible for maintaining control of the sea and is a ready force on watch at home and overseas, capable of strong action to preserve the peace or of instant offensive action to win in war.

It is upon the maintenance of this control that our country's glorious future depends; the United States Navy exists to make it so.

WE SERVE WITH HONOR

Tradition, valor, and victory are the Navy's heritage from the past. To these may be added dedication, discipline, and vigilance as the watchwords of the present and the future.

At home or on distant stations we serve with pride, confident in the respect of our country, our shipmates, and our families.

Our responsibilities sober us; our adversities strengthen us.

Service to God and Country is our special privilege. We serve with honor.

THE FUTURE OF THE NAVY

The Navy will always employ new weapons, new techniques, and greater power to protect and defend the United States on the sea, under the sea, and in the air.

Now and in the future, control of the sea gives the United States her greatest advantage for the maintenance of peace and for victory in war.

Mobility, surprise, dispersal, and offensive power are the keynotes of the new Navy. The roots of the Navy lie in a strong belief in the future, in continued dedication to our tasks, and in reflection on our heritage from the past.

Never have our opportunities and our responsibilities been greater.

CONTENTS

CHAPTER Page

1. The Navy Lithographer 1
2. Job Planning 22
3. Cold Type Composition 36
4. Artwork Preparation 75
5. Photographic Equipment 95
6. Photographic Materials 138
7. The Line Negative 158
8. The Halftone Negative 171
9. Negative Corrections and Stripping 217
10. Platemaking 246
11. The Offset Press 274
12. The Multilith 1250 317
13. The A. B. Dick Offset Duplicator, Model 350 340
14. The ATF 20 and 20A Presses 358
15. Paper and Ink 393
16. Bindery Equipment 422
17. Letterpress Printing 444
18. Shop Administration 479

APPENDIX

I. Additional Reference Reading 505
II. Formulary 512
III. Maintenance of Lithographic Equipment 517
IV. Glossary 519

INDEX 546

Nonresident Career Course follows Index

CREDITS

All illustrations published in this manual are official U.S. Navy illustrations unless designated below.

SOURCE	FIGURES
Reinhold Publishing Co.	1-4
International Business Machines Corp.	3-17, 3-18, 3-19, 3-20, 3-24 through 3-29
Varityper Division of the Addressograph-Multigraph Corp.	3-6 through 3-16; 3-37 through 3-44
Singer Co., Friden Division	3-30, 3-31
Artype, Inc.	3-35
Keuffel & Esser Co.	3-33, 3-34
Inland Printer/American Lithographer	4-22, 17-50
The American Printer	17-50
Herbert P. Paschel and Modern Lithography	5-15, 5-18
Robertson Photo-Mechanix, Inc.	5-41
Consolidated International Equipment and Supply Co.	5-5, 5-23, 5-29, 5-33
Electronic Mechanical Products Co.	5-24
Bellingham Chain and Forge Co.	5-35, 5-36
Kenro-Graphics, Inc.	5-40
Buckingham Graphics, Inc.	5-48
Brown Manufacturing Co.	5-49, 5-50
Art Instruction, Inc.	8-1, 8-3
Philip S. Green	8-9, 8-10, 8-11, 9-10
Eastman Kodak Co.	5-44, 6-9, 7-7, 8-12, 8-14, 8-15, 8-21, 8-26, 8-27, 8-31

SOURCE	FIGURES
Patrick E. Arnold	8-23, 8-24, 8-42, 8-43
Reproductions Review and Methods	8-34
Graphic Arts Technical Foundation	9-20, 15-10
Stouffer Graphic Arts Equipment Co.	7-8, 7-9
NuArc, Co., Inc.	1-11, 5-31, 5-32, 5-34, 5-43, 7-2, 7-3, 7-4, 9-2, 9-3, 10-17
Micro Essential Laboratory, Inc.	6-3
E. I. DuPont de Nemours & Co. (Inc.) Type Founders	8-18, 8-20, 8-25, 8-28, 8-29, 8-30, 10-14, 10-15
American Sales Corp.	11-2 (top), 11-7, 11-9, 11-16, 11-19, 11-21 (top), 11-24, 11-27, 14-1 through 14-45, 16-26, 16-36
Harris Intertype Corp.	11-2 (bottom)
A. B. Dick Co.	11-14, 13-1, 13-2, 13-4 through 13-21, 13-23 through 13-26
Waltwin Publishing Co.	11-15
Technical Trade School, International Printing Pressmens' and Assistants' Union of North America	11-17, 11-29
Miller Printing Machinery Co.	11-30
Hammermill Paper Co.	15-1, 15-2, 15-3, 15-4
AM Corporation	11-5, 11-6, 11-8, 12-1 through 12-4, 12-6 through 12-38
Metalphoto Corp.	10-27, 10-28
Challenge Machinery Co.	16-1, 16-2, 16-17, 16-18, 16-19, 16-20, 16-21, 16-22, 16-33, 16-34
Baumfolder Division, Bell & Howell Co.	16-9, 16-10, 16-15, 16-16,
F. P. Rossback Co.	16-31

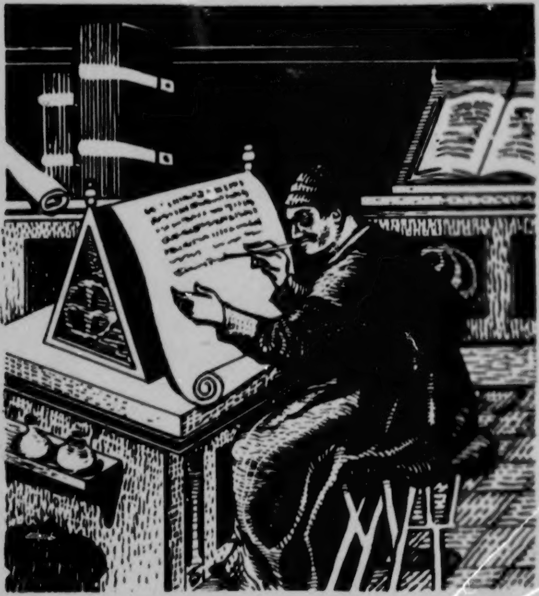
SOURCE	FIGURES
Bostich, Inc.	16-29,
Ludlow Co.	17-8
McKnight & McKnight Publishing Co.	17-12, 17-28
Chandler & Price Co.	17-26, 17-27
Brandtjen & Kluge, Inc.	17-34, 17-39, 17-42, 17-43, 17-44
The Rapid Electrotype Co.	17-48
The Plastic Coating Corp.	10-4, 10-5, 10-6, 10-7
Gevaert Company of America, Inc.	10-8, 10-9
Itek Business Products Div., Photostat Corp.	10-10, 10-11
3M COMPANY	10-20, 10-21, 10-22
C. P. Goerz American Optical Co.	5-13

CHAPTER 1

THE NAVY LITHOGRAPHER

Printing is one of the world's largest industries. It directly affects the lives of every one of us. It is so integrated with our everyday educational, industrial, professional, religious, and domestic needs, that it is almost impossible to imagine ourselves without it.

Yet, only a few hundred years ago there was no printing. All books were hand-lettered by men called scribes; and it often took years to complete a single volume. Sometimes one of the scribes would sit in the center of a room and read aloud from the master copy of a book, such as the Bible, while the others sat around him and copied word for word as he read. By this means they could produce as many as 10 or 20 copies of a book in a year. This was mass production about 1423 A.D. (See fig. 1-1.)



57.1

Figure 1-1.—The scribe at work.

But since the production of hand-lettered manuscripts was distinctly limited, men began looking for quicker methods of reproducing the needed books. At first they tried carving the lettering for an entire page on a block of wood. The block was then inked and proofs were pulled from it. This greatly increased the number of copies that could be reproduced, but it also had many disadvantages. Long tedious hours went into the cutting of the blocks, and once the required number of copies had been printed, the blocks were of no further use.

Finally in 1453, John Gutenberg invented a mold for casting separate metal letters called type. These raised letters could be combined or "set" to form words and lines. When enough lines had been set to fill a page, they were put in a press, inked, and printed or impressed on paper. After the required number of impressions had been made, the letters were separated and used again in new combinations for setting the next page. Gutenberg's modest invention marked the beginning of printing as we know it today.

Printing has come a long way since the fifteenth century. Down through the years, it has grown in stature and importance until it has become a great, modern industry. But modern production requires a speed and accuracy unknown to the early printers. And in their efforts to meet these demands, men have developed a number of different methods of reproduction. So, today, all printing is not done the same way.

KINDS OF PRINTING

Gutenberg's process, known as Letterpress or Relief Printing, is still the medium most commonly used; and when one speaks of printing, he generally refers to it. But looking directly over its shoulder is a newer process—one in which the printing is done from a flat, metal plate through the use of chemicals. This process is called offset lithography. There is still another process, known as intaglio printing, which utilizes an image that is engraved or etched below the surface of the metal plate. Figure 1-2 shows the principle involved in each of these printing processes.

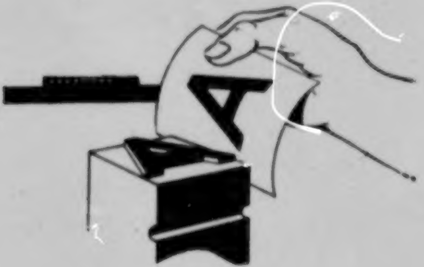
Letterpress Printing

Letterpress printing is done entirely from raised surfaces, such as type and cuts. As you have just seen, type consists of raised letters cut on blocks of wood or cast on metal shafts. These letters are set or grouped together to form words and lines. The raised surfaces of the letters are then inked and pressed against a sheet of paper to make a print or impression. (See fig. 1-2.) Most newspapers and magazines are printed by the letterpress process.

Intaglio Printing

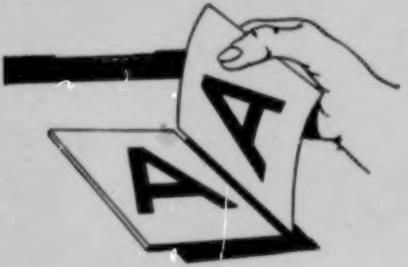
The intaglio printing process is exactly the opposite of letterpress printing. In this process, the letters or designs to be printed are etched below the surface of a metal plate. When the plate is inked, the etched areas form tiny reservoirs of ink. The surface of the plate is then wiped clean so that when paper is forced against it, only the ink-filled areas reproduce. (See fig. 1-2.)

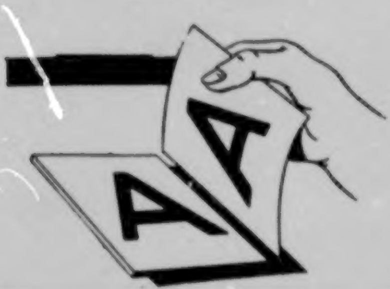
Engraved stationery, paper money, and postage stamps are reproduced by the intaglio process. Rotogravure is also a form of intaglio printing. The magazine section of many of our Sunday newspapers and parts of mail order catalogs are printed by the gravure process.



Letterpress printing consists of pressing paper against a raised inked letter. Since only the raised surface of the letter takes ink, the low areas do not print.

Intaglio (pronounced in-tahl-yo) printing consists of pressing a sheet of paper against a plate having etched-out areas filled with ink. Although the surface of the plate inks up during inking operations, it is wiped clean before each impression so that only the etched-out areas print.





Planographic printing consists of pressing paper against a flat letter (one which is neither raised nor etched below the surface of the plate). Only the letter inks up, because the nonprinting areas of the plate are chemically treated to repel the ink.

57.2

Figure 1-2.—Comparison of the three main printing processes.

Lithographic Printing

Lithography is another important printing process. It is also known by such names as planography and photo-offset. This type of printing is different from either letterpress or intaglio printing, yet the results produced are similar. In lithographic printing, the design is either drawn by hand or reproduced photographically on a flat, metal plate.

As you can see in figure 1-2, the design is neither raised nor sunken. It is the same height as the blank, nonprinting areas around it. This perhaps leads you to wonder why the nonprinting areas don't ink up along with the image when the plate is put on the press. They undoubtedly would, if they were not chemically treated to repel the ink. As a result, only the image takes the ink, and the nonprinting areas remain clean, showing up on the paper as white space.

Other Reproduction Processes

In addition to the three main types of printing just discussed, there are other reproduction processes, such as mimeographing, gelatin duplicating, silk screening, and so on. These processes are not considered to be printing in the strictest sense, however, so they will not be discussed in this book. This book covers only lithographic and letterpress printing because they are the ones you will need to master.

Offset lithography is the fair-haired boy in the printing world today. Thanks to modern improvements during the past 30 years, it has become one of the fastest and most economical means of reproduction. And it is still growing in both size and scope. So you've made a good choice in deciding to become a lithographer. You will find the field growing in importance in the Navy too–just as it is in civilian life.

WHAT IS OFFSET LITHOGRAPHY?

Offset lithography is a practical outgrowth of old-fashioned stone lithography. Stone lithography, of course, is not new. It was discovered in Europe in 1796 by a man named Alois Senefelder. He found, quite by accident, that if he wrote with grease pencil on a certain type of stone and then wet the stone with water, that he could apply ink to the grease image without inking up the rest of the stone. He could then make as many prints as he desired by simply wetting and re-inking the stone before each impression. He called the process lithography which means "stone writing."

Basic Principle of Lithography

Lithography is based on the simple principle that oil will not mix with water. An example will help to make this clear.

Suppose that you added some red dye to a pan of water. What would happen? The water would turn red. But if you poured some thin oil paint into the plan, the water would not be affected–because oil and water will not mix.

Since the two will not mix, the color would float on the surface of the water in a kind of greasy design. If a sheet of paper were placed on the water, it would absorb the color, and the design would thus be transferred to the paper.

This system is used in binderies for "marbling" the edges of books. The bookbinder pours oil paints into a container of water and stirs them to produce various designs. Then he clamps the book tightly so that the colors will not seep between the pages and touches the edges of the book to the colors on the water. The paper absorbs the colors, and a beautiful marbled design is produced.

The marbling process is similar in principle to lithographic printing. However, because the water is fluid, the image is unstable, and it is therefore impossible to produce a series of prints that are exactly alike in design. Since a stable image is required for producing like designs, the image must be fixed or anchored to a solid material, such as the lithographic stone or plate.

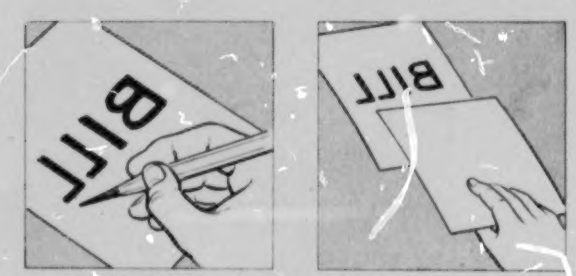
Stone Age of Lithography

For many years after Senefelder's discovery, the stone was used exclusively as the master plate in making lithographic prints. However, with the introduction of zinc and aluminum plates, the popularity of the stone waned fast, and today, it is rarely used.

The original lithographic stones were a limestone possessing certain qualities that were especially suitable for lithographic printing. They absorbed grease readily and were porous enough to hold moisture; yet they provided a smooth working surface. These stones came in sizes up to 44 x 62 inches and were often from 3 to 5 inches thick. Stones like these frequently weighed more than half a ton.

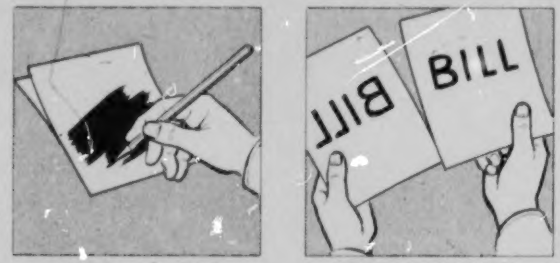
All printing matter was drawn on these stones by hand. The designs were drawn in reverse so that the prints would read forward. To understand this better, take a look at the experiment shown in figure 1-3.

Here's how it works: print a word backwards on a sheet of paper with a soft pencil. Then lay another sheet of paper over it and rub the back of the second sheet with your pencil as shown in figure 1-3. You will find that the word will transfer to the second sheet—reading forward. The more complex lithographic designs were reversed in this same manner.



USING SOFT PENCIL WRITE A WORD ON PAPER IN REVERSE

COVER IT WITH ANOTHER SHEET OF PAPER



RUB THE BACK OF THE SECOND SHEET WITH YOUR PENCIL

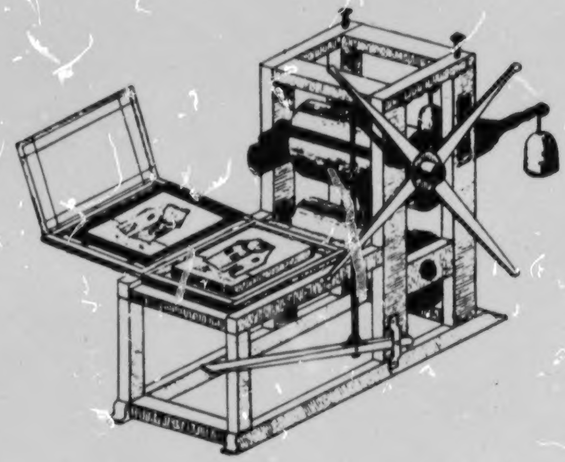
AND THE WORD WILL TRANSFER TO THE SECOND SHEET READING FORWARD

57.3

Figure 1-3.—The principle involved in reversing designs for lithographic printing.

Flatbed Presses

Lithographic printing, as you have just seen, requires moistening the stone and re-inking it before each impression. These operations were done by hand on the first crude lithographic presses. Figure 1-4 shows one of these presses, which were known as "flatbed" presses because the lithographic stone rested on a flat bed. Two printers had to work hard to turn out 1,000 impressions a day on such a press.



57.4X

Figure 1-4.—An early flatbed lithographic press.

Cylinder Presses

Later lithographic presses were equipped with automatic dampening and inking rollers, as well as a cylinder for carrying the paper. The stone was placed on the flat bed which shuttled back and forth alternately under the dampening and inking rollers and the impression cylinder which carried the paper. The cylinder revolved at the same rate of speed as the bed and pressed the paper against the stone to make the impression. These automatic cylinder presses upped production to 5,000 impressions a day. They were the forerunners of the modern, highspeed offset presses in use today.

Rotary Presses

Lithography quickly became a favorite means of producing artwork, pictures, maps, and posters in full colors. But regular black-and-white lithographic processes were too slow and expensive to offer any real competition to the already established letterpress process. Commercially, lithography was viewed with interest, but little enthusiasm.

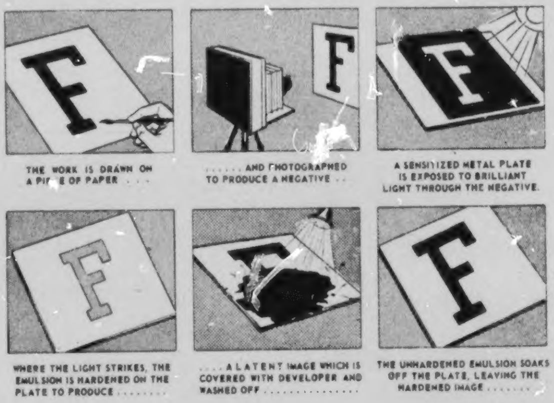
However, lithography gained ground with the coming of zinc and aluminum plates. When properly treated, these plates could absorb grease and water just as well as the lithographic stone. And unlike the stone, they were light and pliable, and could easily be fastened around a cylinder.

Experiments with them led to the development of the rotary press. This press consisted of two cylinders which rotated in the same direction. The plate was carried on one and the paper on the other. They were synchronized to meet at the same rate of speed and thus produce an even impression. This new type of press raised production to approximately 1,000 impressions per hour.

Enter Photography

Soon after the development of photography in 1839, lithographers began using it to produce images on their stones. By 1860, zinc plates were being successfully reproduced with the aid of a camera. This working partnership between photography and lithography came to be known as photolith or photolithography.

However, in spite of its early advances, photography was not generally used for producing lithographic plates until the turn of the century. It has developed quickly in recent years, of course, and is now used extensively both in the Navy and outside. (See fig. 1-5.)


THE WORK IS DRAWN ON A PIECE OF PAPER . . .
. . . . . . AND PHOTOGRAPHED TO PRODUCE A NEGATIVE . .
A SENSITIZED METAL PLATE IS EXPOSED TO BRILLIANT LIGHT THROUGH THE NEGATIVE.
WHERE THE LIGHT STRIKES, THE EMULSION IS HARDENED ON THE PLATE TO PRODUCE . . . .
. . . . A LATENT IMAGE WHICH IS COVERED WITH DEVELOPER AND WASHED OFF . . . .
THE UNHARDENED EMULSION SOAKS OFF THE PLATE, LEAVING THE HARDENED IMAGE . . . .

57.5

Figure 1-5.—Photolithographic process of platemaking.

OFFSET PRESSES AND OFFSET LITHOGRAPHY

It is important to remember that all the printing thus far discussed has been direct printing. That is, the impressions are made on the paper directly from the stone or plate. Tin decorators had been using an indirect (offset) printing process for many years, but no serious consideration had been given to applying this method to printing on paper until 1906 when Ira Rubel, a lithographer at Nutley, N.J., conceived the idea for an offset press designed specifically for this purpose.

Here again, as with Senefelder and the limestone, fate stepped in to lend a hand. It all started one afternoon while Rubel was watching paper being fed into a cylinder press. The pressman missed feeding a sheet, and the plate made its impression on the cylinder packing. Naturally, the next sheet fed through printed on both sides. (The plate pressed the paper against the cylinder packing, and the fresh ink left there by the previous impression was offset onto the back of the sheet.)

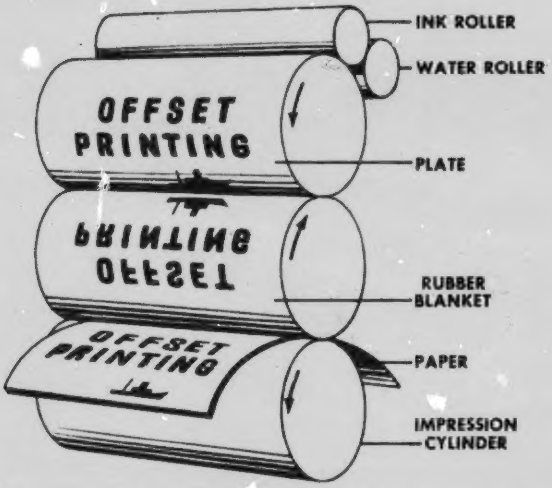
This gave Rubel an idea, and shortly thereafter, he came up with a new type of press which offset the image onto the paper instead of printing it on directly, as before.

Rubel's press had an extra cylinder which was covered with a rubber blanket. The image from the plate was printed first on this blanket and was then transferred from the blanket to the paper stock. This press brought a new versatility to lithographic printing. Since the stock did not contact the plate directly, less water was transferred to the paper and this made it possible to print on a greater variety of stocks and to use less fountain solution in the press. The resiliency of the rubber blanket also enabled lithographers to print on stocks having a rough or coarse surface, and it reduced wear on the plate and lengthened the life of the printing image.

Figure 1-6 shows the principle of the offset press. It is important that you understand it, because you will be working almost exclusively with this type of press.

The printing unit consists of an ink fountain and rollers, a water fountain and rollers, and three large metal cylinders. The plate is attached to the top cylinder, as you can see in the illustration. The rubber blanket is attached to the center cylinder, and the bottom cylinder carries the paper through the press, forcing it against the rubber blanket to make the printed impression.

When the press is in operation the cylinders revolve, and the plate is carried first under the dampening rollers, and then under the inking rollers, and finally against the rubber blanket. The dampening rollers thus keep the nonprinting areas of the plate wet so that they will not take ink when the plate passes under the ink rollers. As a result only the image is inked. After the plate passes under the ink rollers, it contacts the blanket cylinder, transferring the inked image to the blanket. The blanket, in turn, offsets or prints the wet image on the paper which is forced against it by the impression cylinder.



57.6

Figure 1-6.—Simple diagram of the printing unit of an offset press.

You will recall from the experiment described in figure 1-3 that in direct lithographic printing, the image was drawn on the plate in reverse so that it would read "forward" when the job was printed on the paper. Offset printing works just the opposite. The image reads forward on the plate, backward on the blanket, and forward again on the paper. Look at figure 1-6 again. It illustrates this point very clearly.

Lithographic processes are called by many different names—planography, zincography, photolith, photolithography, and so on. These names sound confusing, and often are. But they needn't be, because most of them are just variations of the same old process. However, it is important to know that if a job is printed on an offset press from a lithographic plate, it is called offset printing. And if photography is used in making the plate, it becomes photo-offset printing. It is not photo-offset or photolithography, however, unless photography is involved.

THE WHOLE PICTURE

By now you are probably full of isolated bits of information on lithography. So let's fit the pieces together and see just what goes on in a lithographic plant.

Planning and Production

Planning the work is the first step. The lithographer must study each job and decide how it can best be produced with the equipment he has on hand. Sometimes he sketches it or lays it out in rough visual form to show the positions of the type and illustrations on the page. He may also prepare a specification sheet to show such pertinent information as the color of ink, kind of paper to be used, the size of the page, and the number of copies required.

Following closely is the second step called copy preparation. It consists of such operations as drawing illustrations, retouching photographs, typing the text, pulling proofs from type, and pasting all the work together or assembling it for the camera. (See figs. 1-7 and 1-8.)

From Copy to Film

The third step takes place in the camera room. There the cameraman photographs or copies the work with a camera. (See figs. 1-9 through 1-12.) He then develops the film (negative) and sends it to the stripping department, where it is examined for defects and corrected and retouched if necessary. Several negatives may then be stripped (taped) together in their proper printing positions on a sheet of yellow-orange paper, called goldenrod. Windows are cut in the paper to expose the printing (transparent) areas of the negatives. These areas will then print on the plate, but the areas masked off by the goldenrod paper will not.

Making the Plate

The next step occurs in the plate room. (See fig. 1-13.) There the platemaker places a thin metal plate that has been coated with a light-sensitive solution in a vacuum frame and positions the negative assembly over it. He then exposes the plate to a bright light.

During the exposure, the light passes through the transparent areas of the negatives and hardens the coating on the plate wherever it strikes. After the operator removes the plate from the vacuum frame, he develops it with chemicals which dissolve the unhardened areas of the coating, leaving the light-hardened areas on the plate as the printing image.

Going to Press

The plate is then sent to the pressroom, figures 1-14 and 1-15 where it is clamped on the cylinder of the offset press. You have already seen in figure 1-6 how impressions are made on this press.

Bindery Operations

When the job leaves the pressroom, it is taken to the bindery, where it is folded, stitched, cut, trimmed, padded, or punched, as required. This is the final operation. (See figs. 1-16 and 1-17.)

In large printing houses there are specialists for each of these jobs, and they are required to do only one particular phase of the work, but as a Navy lithographer you must be able to perform all of these operations.

Of course, you may do only camera work or platemaking at one time and nothing but press work at another. But whatever your specialty, you will still need a working knowledge of all the operations in your shop.

OFFSET LITHOGRAPHY IN THE NAVY

Offset lithography first entered the picture aboard ship in 1940 when a Model 296 Multilith press was installed aboard the U.S.S. Maryland (BB-46).

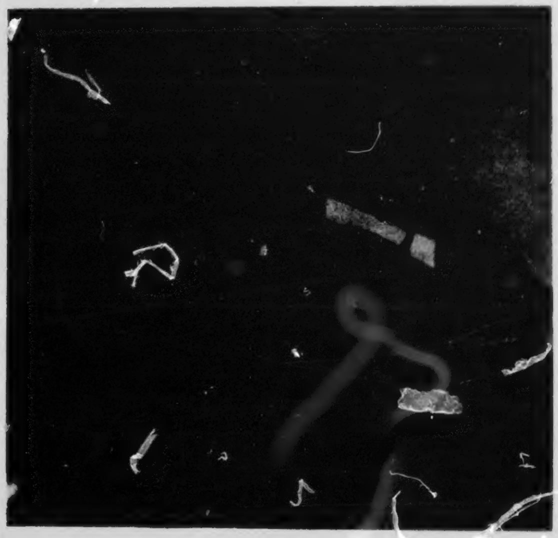
Previous to this, all printing had been done on letterpress equipment by personnel in the Printer rating. The first printers in the Navy were designated "ship's printers," a title that dates back to the 1860's. The rating later became Printer and in 1921 paygrades from Third Class to Chief Petty Officer were established.

The transition from letterpress to offset equipment wasn't enthusiastically welcomed by some of the old timers both in the Navy or in commercial shops. The old timer was apt to scowl like you had just kicked his dog when he was asked to work with the new lithographic process. He knew that anything could happen and probably would when he tried running a job on the new offset press.

In those early days of offset printing there often were problems with maintaining the correct ink and water balance on the presses. Also the light-sensitive coatings used on the plates varied in density and sensitivity from one weather condition to another. This problem affected shipboard equipment in particular as the ships would move from one climate to another in a short period of time. Early offset printing was a process of trial and error with each shop developing its own chemical formulas and techniques.

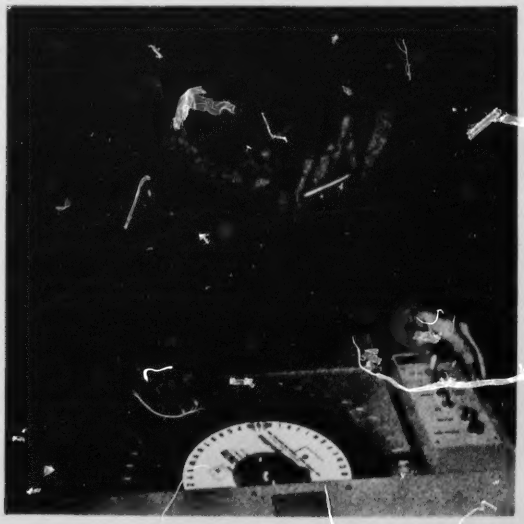
Nevertheless, lithography and offset printing continued to grow and in 1943, 17" X 22" ATF Chief Webendorfer offset presses were installed aboard five new amphibious force flagships.

If the Navy ever had any doubt that offset printing had the capacity to do a real job, it was



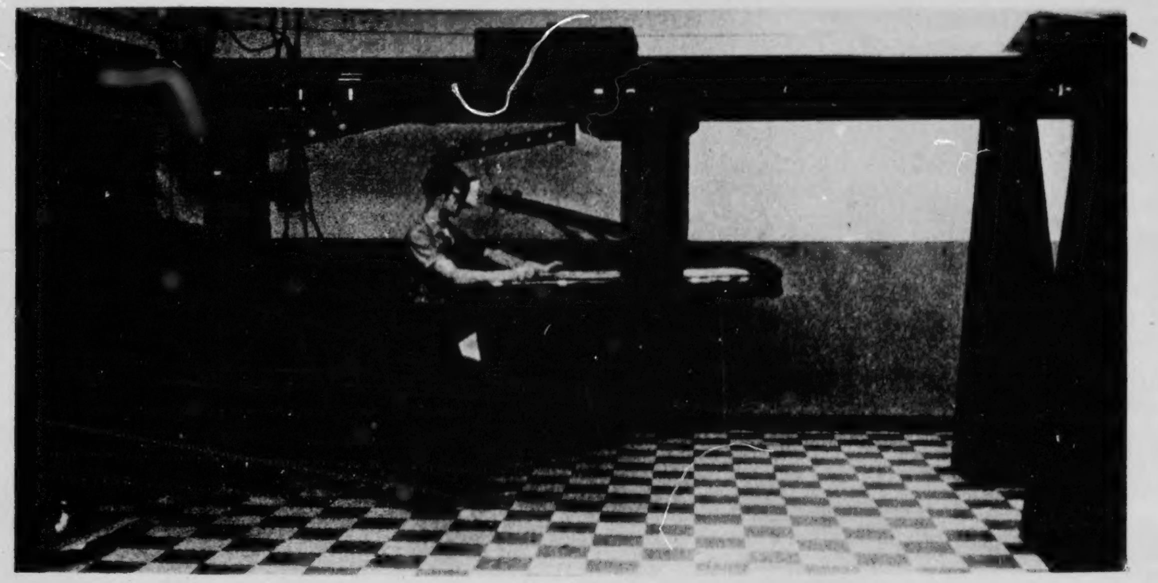
57.14(57C)

Figure 1-7.—Preparing composition on a Varityper.



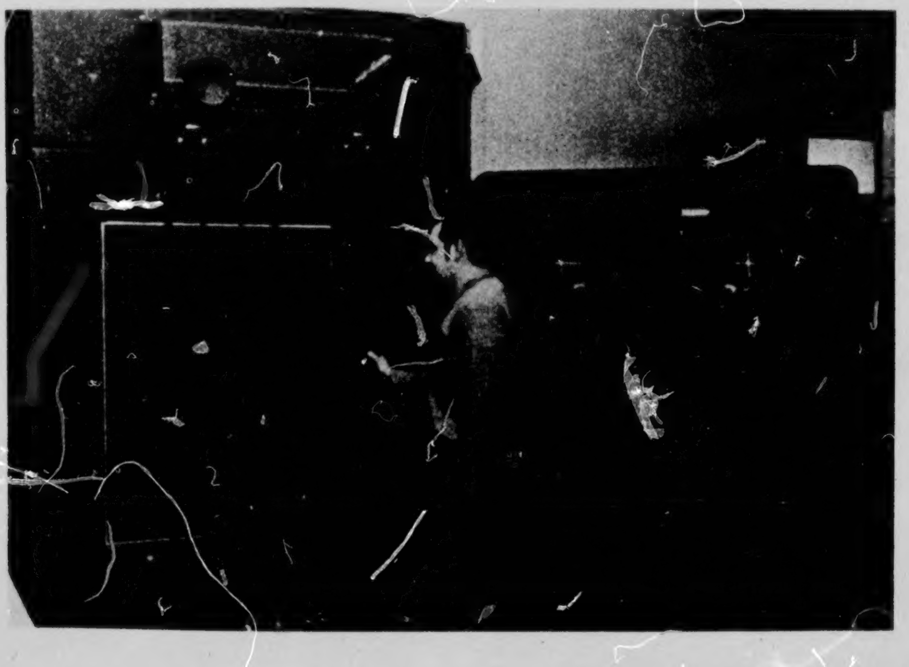
57.21.0(57C)

Figure 1-8.—Setting display type on a headliner.



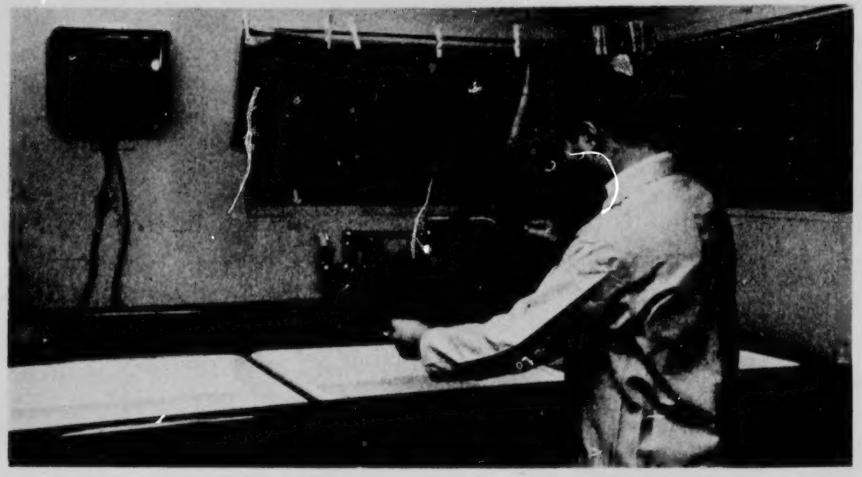
57.685

Figure 1-9.—Loading copy on the copyboard of a large process camera. You will find smaller cameras aboard ship.



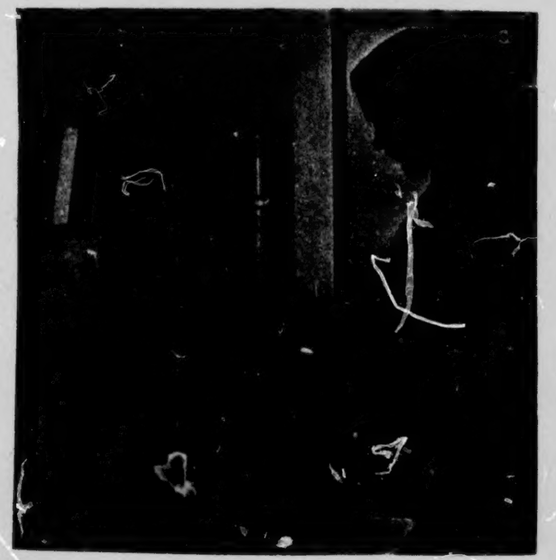
57.686

Figure 1-10.–The camera back where the film is placed to make the exposure.



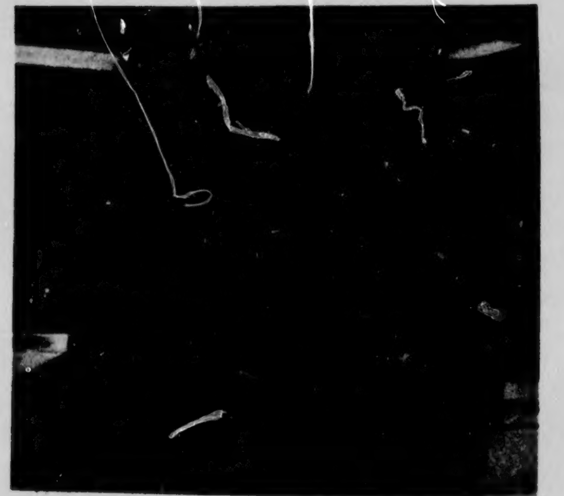
57.687X

Figure 1-11.–Film is developed in trays in a temperature-controlled sink.



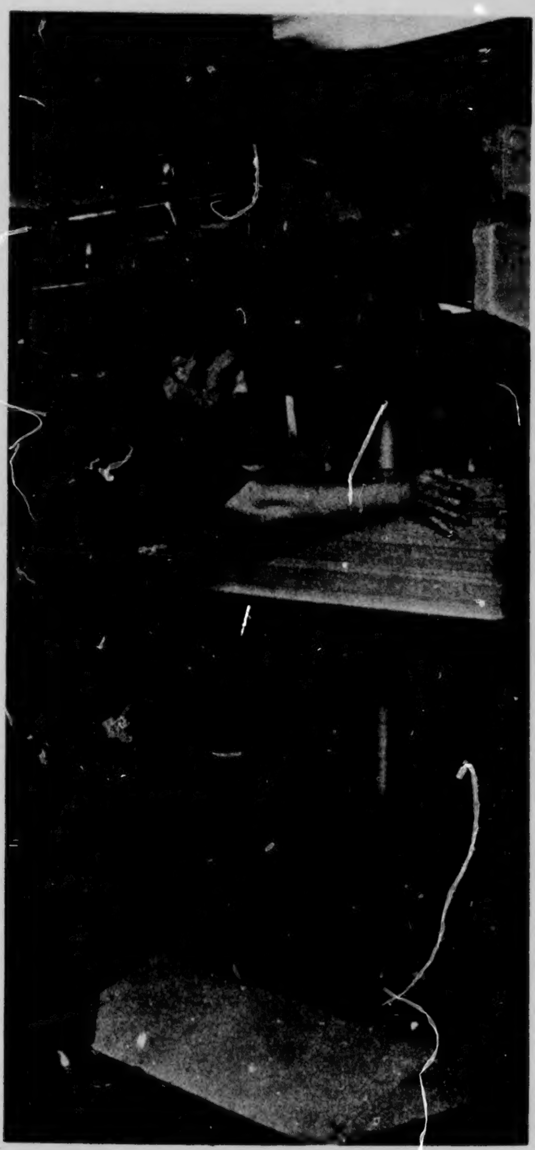
57.688

Figure 1-12.—Squeegeeing a negative in a washer-viewer sink.



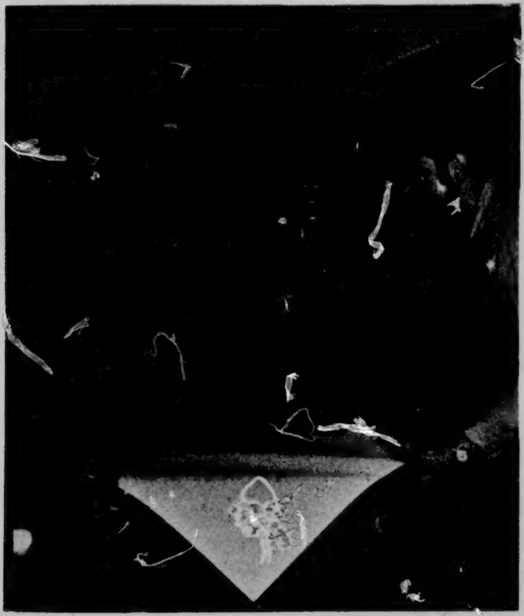
57.689

Figure 1-13.—Exposing a plate.

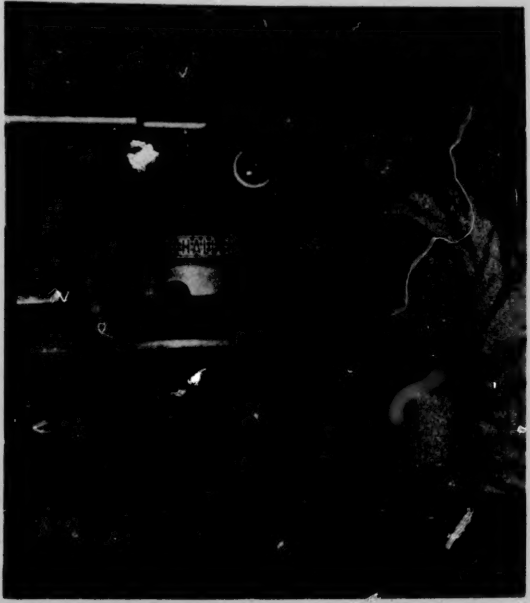


57.690

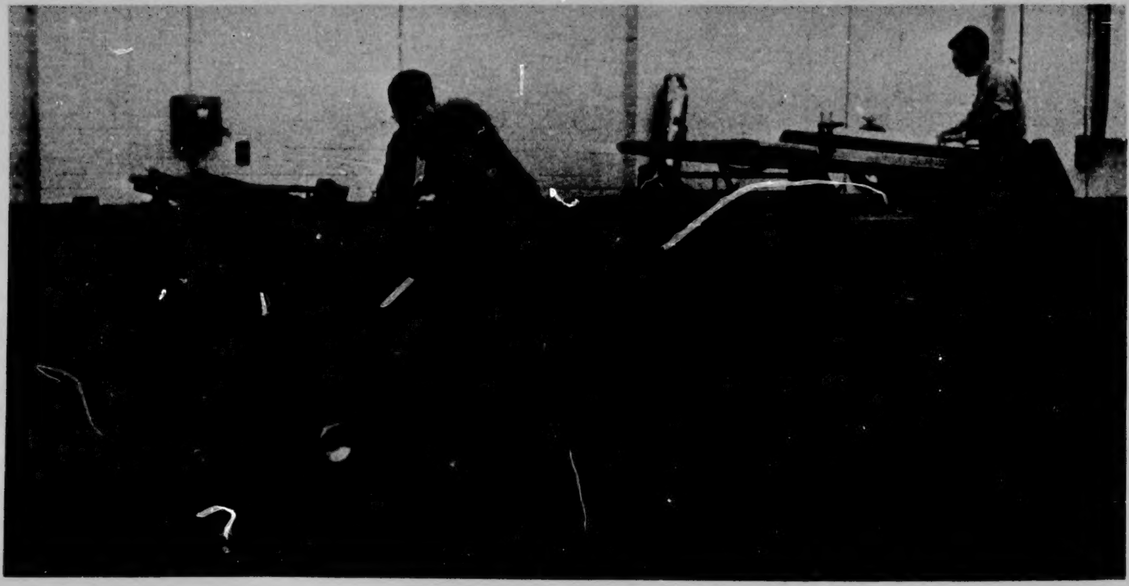
Figure 1-14.—Loading paper in the feeder of a 23" X 36" Miller offset press.



57.691
Figure 1-15.–The delivery end of the press shown in figure 1-14.



57.692
Figure 1-16.–Setting the cutting depth on a paper cutter. Cutting paper is considered a bindery operation.



57.684
Figure 1-17.–Operating a folder in a bindery of a large Navy printing plant ashore.

dispelled in 1944. The invasion of France gave the new process a severe test. Two great task forces were scheduled to strike at Normandy. The western force, made up of U.S. units, consisted of two assault forces and a follow-up force—in all 2,479 ships. Naturally, the preparations for the big offensive were tremendous. Unprecedented quantities of printed materials, including maps, charts, aerial photographs, and operational data, were needed.

The U.S.S. *Ancon* (AGC-4) was the only ship in this massive armada that had a complete lithographic shop, so all attention turned to it. The *Ancon's* print shop was faced with not only supplying nearly all of the printing needs of the entire fleet, but it had to be done with all speed. The veteran print shop crew and the new equipment rose to the occasion and met the challenge.

Offset printing also came of age ashore in the Navy. At the outbreak of World War II there were only two naval shore activities equipped to produce offset printing; the Naval Hydrographic Office and the Naval Communications Center. Needless to say, the situation quickly changed. Lithographic equipment and supplies began pouring into five depots from Philadelphia to Guam. A school was also set-up to train men to operate the new equipment. Soon the Navy had advance base units in Guam, London, Pearl Harbor, Melbourne, and Algiers.

In 1948 the Lithographer (LI) rating was established. Chosen as the speciality insignia were two tools of early lithography: a litho crayon holder and a scraper knife that was used to sharpen or clean-up the crayon image on the stone. (See fig. 1-18.)

A gradual phasing out of the Printer (PI) rating was begun and continued until the mid-1950's, when the few remaining PIs were converted to LIs. Another milestone in Navy offset printing occurred about the same time when in 1956, the first large offset press, a 22" X 36" Harris, was installed aboard the U.S.S. *Saratoga* (CVA-60).

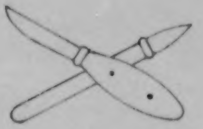

3.10(Li)

Figure 1-18.—Crossed litho crayon holder and scraper knife make-up the Lithographer rating insignia.

Today, amphibious force flagships, aircraft carriers, cruisers, destroyer and submarine tenders, and repair ships all carry fully equipped and up-to-date offset printing plants. In addition, many shops also have letterpress printing capabilities. Aboard ship you will often find the print shop situated close to the photo lab and drafting shop so that these units can assist one another in performing their related duties. In many cases, the Chief Lithographer will also be in charge of these other shops. Ashore, the print shop usually operates under the activity's administrative office.

DUTY AS A NAVY LITHOGRAPHER

Lithographers serve ashore as well as afloat in the larger ships of the fleet. The LI operates and maintains all lithographic and letterpress equipment used by the Navy. Besides general printing, his work may include reproduction of such specialized items as charts, grids, surveys, operation orders, and so on. His work is often classified and may require a security clearance.

As a Lithographer Third, you may be ordered to a billet aboard a Cruiser class ship (CA, CLG), a Command type vessel (CC), an Aircraft Carrier (CVA), or one of the many types of auxiliaries (AD, AR, AS). If you are ordered to a billet ashore, it may be to a flag command (such as CINCLANTFLT or CINCPACFLT), to a Naval Station (such as Bainbridge or Pearl Harbor), to a Communications Unit (such as OpNav), or to an Intelligence Center (such as FICPAC).

When you advance to Lithographer Second, you may be ordered to a leading petty officer billet aboard such ships as a Hospital Ship (AH) or an Amphibious Assault Ship (LPH). Of course there are many LI2 billets aboard ships which are not the leading lithographer for that command. Orders to shore duty may take you to Staff duty in Washington, D.C., Bainbridge, Md., or Charleston, South Carolina. Overseas shore billets for an LI2 include a communications unit in London, a naval station in Iceland, a fleet support activity in Japan, to name a few.

LIs often work closely with Photographer's Mates, Engineering Aids, and Photographic Intelligencemen. If a ship or station newspaper is published, LIs may also deal with personnel of the Journalist rate.

Men with a good working knowledge of basic mathematics, physics and mechanics are well-suited to this trade. Hobbies or interest in photography, printing, optics, design, and so on, indicate that a man would probably do well in the Lithographer rating.

YOU AND THE NAVY

It is impossible to list all the ways in which you, as a Lithographer, will serve the Navy. Much of your duty will concern the routine production of all types of printed materials needed to operate an organization as large as the Navy. There will also be those not-so-routine times when you will be required to work long hours to complete a rush job. Or you may be assigned to a special billet on temporary assignment somewhere, possibly living and working under difficult conditions.

But the most important duty you will have as you advance up the ranks will be as a leader of men. As a petty officer in the Navy, you enter the field of military leadership. Leadership, it has been said, is getting people to do what you want, because they want to do it. There are no hard and fast rules that can be applied to dealing with people and there aren't any courses or books which alone will make you an effective leader. Of course, books and courses in human relations and personnel management will help you to develop the qualities of a good leader.

For the most part, your ability to work with and to lead people will depend on the learning you gain from your experiences and the application of plain, old fashioned commonsense. Keep in mind that nearly everyone, most of all the new man in the Navy, wants to do good work. Your job as a petty officer will be to provide him with the instruction and guidance he needs to continue to do a good job. To give him this and to ensure that he accepts it, you will have to gain his confidence. This is done by showing him that you care about him and his problems, by treating him with consistency and fairness, and by the professional skills you demonstrate.

To be sur[illegible]eadership is not easy. You will have to develop it. Every approach you take as a leader won't be the right one. The time and effort that you expend to become a leader is well spent and will benefit yourself and the Navy.

THE ENLISTED RATING STRUCTURE

The two main types of ratings in the present enlisted rating structure, are general ratings and service ratings.

GENERAL RATINGS identify broad occupational fields of related duties and functions. Some general ratings include service ratings; others do not. Both Regular Navy and Naval Reserve personnel may hold general ratings.

SERVICE RATINGS identify subdivisions or specialties within a general rating. Although service ratings can exist at any petty officer level, they are most common at the PO3 and PO2 levels. Both Regular Navy and Navy Reserve personnel may hold service ratings. There are no service ratings within the LI rating.

NEC's

The Navy Enlisted Classification Coding System (NEC) has been set up to help the Navy match the right man with the right job. By identifying billets that require special skills, and by identifying men who have or can develop these special skills, the NEC system provides the Navy with a means of getting maximum usefulness from its manpower. Any man who gains the qualifications associated with one of the special skills is given a code number, called his NEC. There are no NEC's in the Lithographer rating at the 3 and 2 level at the present, however.

THE NAVY ENLISTED ADVANCEMENT SYSTEM

Many of the rewards of Navy life are earned through the advancement system. The basic ideas behind the system have remained stable for many years, but specific portions may change rather rapidly. It is important that you know the system and follow changes carefully. BuPers Notices 1418 will normally keep you up to date.

The normal system of advancement may be easier to understand if it is broken into two parts:

1. Those requirements that must be met before you may be considered for advancement.
2. Those factors that actually determine whether or not you will be advanced.

QUALIFYING FOR ADVANCEMENT

In general, to QUALIFY (be considered) for advancement, you must first:

1. Have a certain amount of time in pay grade.
2. Demonstrate knowledge of material in your mandatory Rate Training Manuals by achieving a suitable score on your command's test, by successfully completing the appropriate NRCC's or, in some cases, by successfully completing an appropriate Navy school.
3. Demonstrate the ability to perform all the practical requirements for advancement by completing the Record of Practical Factors, NavEdTra 1414/1.
4. Be recommended by your commanding officer.
5. For petty officer third and second candidates ONLY, demonstrate knowledge of military subjects by passing a locally administered MILITARY/LEADERSHIP examination based on the military qualifications for advancement (From NavPers 18068 series).
6. Demonstrate knowledge of the technical aspects of your rate by passing a Navywide advancement examination based on the occupational qualifications applicable to your rate (From NavPers 18068 series, those quals listed at and below your rate level).

Figure 1-19 gives a detailed view of the requirements for advancement of active duty personnel; figure 1-20 gives this information for inactive duty personnel. Remember that the qualifications for advancement can change. Check with your division officer or training officer to be sure that you know the most recent qualifications.

If you meet all of the above requirements satisfactorily, you become a member of the group from which advancements will be made.

WHO WILL BE ADVANCED?

Advancement is not automatic. Meeting all of the requirements makes you eligible but does not guarantee your advancement. Some of the factors that determine which persons, out of all of those QUALIFIED, will actually be advanced in rate are the score made on the advancement examination, the length of time in service, the performance marks earned, and the number of vacancies being filled in a given rate.

If the number of vacancies in a given rate exceed the number of qualified personnel, then ALL of those qualified will be advanced. More often, the number of qualified people exceeds the vacancies. When this happens, the Navy has devised a procedure for advancing those who are BEST qualified. This procedure is based on combining three personnel evaluation systems:

Merit rating system (Annual evaluation and C.O. recommendation)
Personnel testing system (Advancement examination score—with some credit for passing previous advancement exams)
Longevity (seniority) system (Time in Rate and Time in Service)

Simply, credit is given for how much the individual has achieved in the three areas of performance, knowledge, and seniority. A composite, known as the final multiple score, is generated from these three factors. All of the qualified candidates from a given advancement examination population are then placed on one list, based on this composite figure, the highest achiever first, and so on down to the last qualified person in the population. For candidates for E4, E5, and E6, advancement authorizations are then issued, beginning at the top of the list, for the number of persons needed to fill the existing vacancies. Candidates for E7 whose final multiple scores are high enough will be designated PASS SELBD ELIG (Pass Selection Board Eligible). This means that their names will be placed before the Chief Petty Officer Selection Board, a BuPers board charged with considering all so-designated eligible candidates for advancement to CPO. Advancement authorizations for those being advanced to CPO are issued by this board.

E-4 time in service requirements changed by DOD effective 1 July 1975 for advancement to E-4 TIS requirements are increased from 21 months minimum to 2 years.

REQUIREMENTS *	E1 to E2	E2 to E3	# E3 to E4	#† E4 to E5	† E5 to E6	† E6 to E7	† E7 to E8	† E8 to E9
SERVICE	4 mos. service- or completion of Recruit Training.	8 mos. as E-2.	6 mos. as E-3.	12 mos. as E-4. 3 years time in service.	24 mos. as E-4. 6 years time in service.	36 mos. as E-6. 8 years time in service.	36 mos. as E-7. 8 of 11 years time in service must be enlisted.	24 mos. as E-8. 10 of 13 years time in service must be enlisted.
SCHOOL	Recruit Training. (C.O. may advance up to 10% of graduating class.)		Class A for PR3, DT3, PT3, AME 3, HM 3, PN 3, FTB 3, MT 3,			Class B for AGC, MUC, MNC.††		
PRACTICAL FACTORS	Locally prepared check-offs.	Record of Practical Factors, NavEdTra 1414/1, must be completed for E-3 and all PO advancements.						
PERFORMANCE TEST			Specified ratings must complete applicable performance tests before taking examinations.					
ENLISTED PERFORMANCE EVALUATION	As used by CO when approving advancement.		Counts toward performance factor credit in advancement multiple.					
EXAMINATIONS **	Locally prepared tests.	See below.	Navy-wide examinations required for all PO advancements.			Navy-wide selection board.		
RATE TRAINING MANUAL (INCLUDING MILITARY REQUIREMENTS)		Required for E-3 and all PO advancements unless waived because of school completion, but need not be repeated if identical course has already been completed. See NavEdTra 10052 (current edition).					Nonresident career courses and recommended reading. See NavEdTra 10052 (current edition).	
AUTHORIZATION	Commanding Officer		NAVEDTRAPRODEVCEN					

* All advancements require commanding officer's recommendation.

† 1 year obligated service required for E-5, and E-6; 2 years for E-7, E-8, and E-9.

# Military leadership exam required for E-4 and E-5.

** For E-2 to E-3, NAVEDTRAPRODEVCEN exams or locally prepared tests may be used.

†† Waived for qualified EOD personnel.

5.1

Figure 1-19.—Active Duty Advancement Requirements.

REQUIREMENTS *	E1 to E2	E2 to E3	E3 to E4	E4 to E5	E5 to E6	E6 to E7	E8	E9
TOTAL TIME IN GRADE	4 mos.	8 mos.	6 mos.	12 mos.	24 mos.	36 mos. with total 8 yrs service	36 mos. with total 11 yrs service	24 mos. with total 13 yrs service
TOTAL TRAINING DUTY IN GRADE †	14 days	14 days	14 days	14 days	28 days	42 days	42 days	28 days
PERFORMANCE TESTS			Specified ratings must complete applicable performance tests before taking examination.					
DRILL PARTICIPATION	Satisfactory participation as a member of a drill unit in accordance with BUPERSINST 5400.42 series.							
PRACTICAL FACTORS (INCLUDING MILITARY REQUIREMENTS)	Record of Practical Factors, NavEdTra 1414/1, must be completed for all advancements.							
RATE TRAINING MANUAL (INCLUDING MILITARY REQUIREMENTS)	Completion of applicable course or courses must be entered in service record.							
EXAMINATION	Standard Exam		Standard Exam required for all PO advancements. Also pass Military Leadership Exam for E-4 and E-5.				Standard Exam, Selection Board.	
AUTHORIZATION	Commanding Officer		NAVEDTRA PRODEVCEN					

* Recommendation by commanding officer required for all advancements.
† Active duty periods may be substituted for training duty.

5.2

Figure 1-20.—Inactive Duty Advancement Requirements.

Who, then, are the individuals who are advanced? Basically, they are the ones who achieved the most in preparing for advancement. They were not content to just qualify; they went the extra mile in their training, and through that training and their work experience they developed greater skills, learned more, and accepted more responsibility.

While it cannot guarantee that any one person will be advanced, the advancement system does guarantee that all persons within a particular rate will compete equally for the vacancies that exist.

To prepare for advancement, you must study the qualifications for advancement, work on the practical factors, study the required rate training manuals and study other materials that are required for advancement in your rating.

QUALS MANUAL

The *Manual of Qualifications for Advancement*, NAVPERS 18068-C, gives the minimum occupational and military qualification standards for advancement to each pay grade with each rating. This manual is called the "*Quals Manual*," and the qualifications themselves are often called "Quals." The qualifications standards are of two general types: (1) military qualification standards and (2) occupational qualifications standards.

MILITARY STANDARDS are requirements that apply to all ratings rather than any one rating. Military requirements for advancement to third class and second class petty officer rates deal with military conduct, naval organization, military justice, security, watch standing and other subjects which are required of petty officers in all ratings.

OCCUPATIONAL STANDARDS are requirements that are directly related to the work of each rating.

Both military requirements and the occupational qualification standards are divided into subject matter groups; then, with each subject matter group, they are divided into Practical Factors and Knowledge Factors. Practical Factors are things you must be able to do. Knowledge Factors are things you must know in order to perform the duties of your rating.

In most subject matter areas, you will find both practical factors and knowledge factor qualifications. In some subject matter areas you may find only one or the other. It is important to remember that there are knowledge aspects to all practical factors and practical aspects to all knowledge factors. Therefore, even if the *Quals Manual* indicates that there are no knowledge factors for a given subject matter area, you may still expect to find examination questions dealing with the knowledge aspects of the practical factors listed in that subject area.

You are required to pass a Navy-wide military leadership examination for E-4 and E-5, as appropriate, before you take the occupational examination. The military leadership examinations are administered on a schedule determined by your commanding officer. It consists of 100 questions based on information contained in *Military Requirements for Petty Officer 3 and 2*, NAVPERS 10056 (current edition) and in *Bibliography for Advancement Study*, NAVEDTRA 10052 (current edition).

The Navy-wide occupational examination for pay grades E-4 and E-5 contains 150 questions related to the occupational areas of your rating, i.e., lithography.

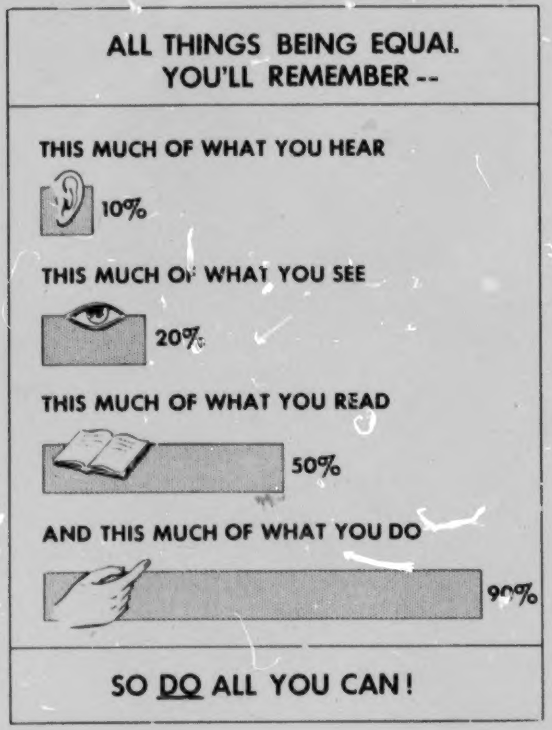
If you are working for advancement to second class remember that you may be examined on third class qualifications as well as on second class qualifications.

The *Quals Manual* is kept current by means of changes. The occupational qualifications for your rating which are covered in this training manual were current at the time the manual was printed. By the time you are studying this material, however, the quals for your rating may have changed. Never trust any set of quals until you have checked it against an up-to-date copy of the *Quals Manual*.

RECORD OF PRACTICAL FACTORS

Before you can take the service-wide examination for advancement, there must be an entry in your service record to show that you have qualified in the practical factors of both the military and occupational qualifications. See figure 1-21.

You have already seen that the *Record of Practical Factors*, NAVEDTRA 1414/1 is used to keep a record of your practical factor qualifications. This form is available for each



4.1

Figure 1-21.—You learn by doing.

rating. The form lists all practical factors, both military and occupational. As you demonstrate your ability to perform each practical factor, appropriate entries are made in the DATE and INITIAL columns.

Changes are made periodically to the *Manual of Qualifications for Advancement*, and revised editions of NAVEDTRA 1414/1 forms are provided when necessary. Extra space is allowed on the Record of Practical Factors for entering additional practical factors as they are published in changes to the *Quals Manual.*

The Record of Practical Factors also provides space for recording demonstrated proficiency in skills which are within the general scope of the rating but which are not identified as a minimum qualification for advancement.

Until completed, the NAVEDTRA 1414/1 form is held by your division officer; after completion, it is forwarded to the personnel office for insertion in your service record. If you are transferred before qualifying in all practical factors, the incomplete form should be forwarded to your next duty station. You can save yourself a lot of trouble by making sure that this form is actually inserted in your service record before you are transferred. If the form is lost or not in your service record you will be required to start all over again and requalify in the practical factors which have already been checked off.

NAVEDTRA 10052

The *Bibliography for Advancement Study*, NAVEDTRA 10052 (revised), is a very important publication for any enlisted person preparing for advancement. This Bibliography lists required and recommended rate training manuals and other reference materials to be used by personnel striving for advancement. NAVEDTRA 10052 is revised and issued each year by the Chief of Naval Education and Training Support Command. Each revised edition is identified by a letter following the NAVEDTRA number. When using this publication, be sure that you have the most recent edition.

If extensive changes in qualifications occur in any rating between the annual revisions of NAVEDTRA 10052, a supplementary list of material may be issued in the form of a Notice. When you are preparing for advancement, check to see whether changes have been made in the qualifications for your rating. If changes have been made, see if a Notice has been issued to supplement NAVEDTRA 10052 for your rating.

The required and recommended references are listed by pay grade in NAVEDTRA 10052. If you are working for advancement to third class, study the material for third class. If you are working for advancement to second class, study the material for second class, and remember that you are also responsible for the references listed at the third class level.

In using NAVEDTRA 10052 you will notice that some rate training manuals are marked with an asterisk (*). Any manual marked in this way is MANDATORY—that is, it must be completed at the indicated rate level before you are eligible to take the service-wide examination for advancement. Each mandatory manual may be completed by (1) passing the appropriate nonresident career course that is based on the mandatory training manual; (2) passing a locally prepared test based on the information given in the training manual; or (3) in some cases, successfully completing an appropriate Navy school.

Do not overlook the section of NAVEDTRA 10052 which lists the required and recommended references relating to military qualification standards for advancement. Personnel of all ratings must complete the mandatory military requirements training manual for the appropriate rate level before they can be eligible to advance.

References in NAVEDTRA 10052 which are recommended but not mandatory should also be studied carefully. All references listed in NAVEDTRA 10052 may be used as source material for the examination writer, at the appropriate rate levels.

RATE TRAINING MANUALS

There are two general types of rate training manuals. RATING MANUALS (such as this one) are prepared for most enlisted ratings. A rating manual gives information that is directly related to the occupational qualifications of ONE rate. SUBJECT MATTER MANUALS or BASIC MANUALS, such as *Introduction to Naval Electronics*, give information that applies to more than one rating.

Rate training manuals are revised from time to time to keep them up-to-date technically. The revision of a rate training manual is identified by a letter following the NAVPERS, NAVTRA or NAVEDTRA number. You can tell whether any particular copy of a training manual is the latest edition by checking the NAVPERS/NAVTRA/NAVEDTRA number and the letter following this number in the most recent edition of *List of Training Manuals and Correspondence Courses*, NAVEDTRA 10061. (NAVEDTRA 10061 is actually a catalog that lists all current training manuals, correspondence courses and nonresident career courses; you will find this catalog useful in planning your study program).

As a result of the establishment of the Naval Education and Training Support Command under the Chief of Naval Education and Training, new editions of training publications formerly designated as NAVPERS or NAVTRA publications are being redesignated as NAVEDTRA publications. The number and edition is unchanged when the books are revised but NAVEDTRA is used before the number instead of NAVPERS or NAVTRA.

Each time a rate training manual is revised, it is brought into conformance with the official publications and directives on which it is based; but during the life of any edition, discrepancies between the manual and the official sources are almost certain to arise because of changes to the latter which are issued in the interim. In the performance of your duties, you should always refer to the appropriate official publication or directive. If the official source is listed in NAVEDTRA 10052, the Naval Education and Training Program Development Center uses it as a source of questions in preparing the fleetwide examinations for advancement. In case of discrepancies between any publications listed in NAVEDTRA 10052 for a given rate, the NAVEDTRAPRODEVCEN will use the most recent material.

The following suggestions may help you to make the best of this manual and other Navy training publications in learning your job and in preparing for advancement.

- Study the military qualifications and the occupational qualifications for your rating before you study the training manual, and refer to the quals frequently as you study. Remember, you are studying the manual primarily to meet these quals.

- Set up a regular study plan. It will probably be easier for you to stick to a schedule if you can plan to study at the same time each day. If possible, schedule your studying for a time of the day when you will not have too many interruptions or distractions.

- Before you begin to study any part of the manual intensively, become familiar with the entire book. Read the preface and the table of contents. Check through the index. Look at the appendices. Thumb through the book without any particular plan, looking at the illustrations and reading bits here and there as you see things that interest you.

- Look at the training manual in more detail, to see how it is organized. Look at the table of contents again. Then, chapter by chapter, read the introduction, the headings, and the subheadings. This will give you a pretty clear picture of the scope and content of the book. As you look through the book in this way, ask yourself some questions:

What do I need to learn about this?
What do I already know about this?
How is this information related to information given in other chapters?
How is this information related to the work I will be expected to do?

- When you have a general idea of what is in the training manual and how it is organized, fill in the details by intensive study. In each study period, try to cover a complete unit–it may be a chapter, a section of a chapter, or a subsection. The amount of material that you can cover at one time will vary. If you know the subject well, or if the material is easy, you can cover quite a lot at one time. Difficult or unfamiliar material will require more study time.

- In studying any one unit–chapter, section, or subsection–write down the questions that occur to you. Many people find it helpful to make a written outline of the unit as they study, or at least to write down the most important ideas.

- As you study, relate the information in the training manual to the knowledge you already have. When you read about a process, a skill, or a situation, try to see how this information ties in with your own past experience.

- When you have finished studying a unit, take time out to check what you have learned. Look back over your notes and questions. Maybe some of your questions have been answered, but perhaps you still have some that are not answered. Without looking at the training manual, write down the main ideas that you have gotten from studying this unit. Don't just quote the book. If you can't give these ideas in your own words, the chances are that you have not really mastered the information.

- Use nonresident career courses whenever you can. The nonresident career courses are based on rate training manuals or on appropriate texts. As mentioned before, completion of a mandatory rate training manual can be accomplished by passing a nonresident career course based on the rate training manual. You will probably find it helpful to take other nonresident career courses, as well as those based on mandatory manuals. Taking a nonresident career course helps you to master the information given in the training manual, and also helps you see how much you have learned.

- Think of your future as you study rate training manuals. You are working for advancement to third class or second class right now, but some day you will be working toward higher rates. An extra knowledge will help you, both now and later on.

SOURCES OF INFORMATION

Besides training manuals, NAVEDTRA 10052 lists official publications on which you may be examined. You should not only study the sections required but should become as familiar as possible with all the publications you can.

One of the most useful things you can learn about a subject is how to find out more about it. No single publication can give you all the information you need to perform the duties of your rating. You should learn where to look for accurate, authoritative, up-to-date information on all subjects related to the military requirements for advancement and the occupational qualifications of your rating.

Reference Publications

You will find regulations covering the handling and custody of classified materials in the *Navy Security Manual for Classified Information*, OpNavInst 5510.1C.

You should also be familiar with the publications *Department of the Navy Publications and Printing Regulations*, NavExos P-35 and *Government Printing and Binding Regulations* which is published by the Joint Committee on Printing. These publications contain rules and regulations applicable to all naval and Government printing.

The *Navy Stock List of Forms and Publications*, NavSup 2002 (commonly called the Stock Forms Catalog) lists all standard Navy forms available through regular supply channels, and the pamphlet *Guide to Forms Management*, AOInst 5213.31 (Navy Forms Manual) may be used as a guide in designing and preparation of new forms.

These and other basic Navy publications relating to printing and lithography are listed in the reading list at the front of this book. Additional books and magazines for reference reading are listed in appendix I.

Instructions and Notices

All Navy Instructions and Notices which pertain to printing are numbered in the 5600 series. These notices are usually 1 to 4 pages long and are included in the Navy Directives System. They supply latest information regarding printing rules and regulations.

The books mentioned above may be obtained from the education officer of your ship or station, or your leading PO.

TRAINING FILMS

Training films available to naval personnel are a valuable source of supplementary information on many technical subjects. Training films are listed in the *United States Navy Film Catalog*, NAVAIR 10-1-777 (formerly NAVWEPS 10-1-777), published in 1969. Copies of this catalog may be ordered in accordance with the *Navy Stock List of Forms and Publications*, NAVSUP 2002. Monthly supplements to the *Film Catalog* are distributed to catalog holders.

When selecting a film, note its date of issue listed in the Film Catalog. As you know, procedures sometimes change rapidly, thus some films become obsolete rapidly. If a film is obsolete only in part, it may still be of some use.

CHAPTER 2

JOB PLANNING

In the Navy, much of your work will consist of reprinting existing copy. No copy preparation will be necessary for these jobs because they will have already been run before and are in printable form. All you need is a good, clean proof or sample of the job that is to be reprinted. This type of job is termed "camera-ready".

The cameraman will photograph the sample to produce a negative and the negative will be used to produce the printing plate.

A different procedure must be followed if the job has not been printed before. New jobs must be planned and put into printed form. The planning and preparations that go into a job are called copy preparation. Copy preparation includes preparing a layout, making a dummy, selecting type styles, preparing the type matter using cold type composing machines, ruling in with pen and ink, and preparing original artwork.

All jobs will not require the same amount of copy preparation. The program for a change of command ceremony requires considerably more copy preparation than a single page form for the personnel office.

Depending on your duty assignment, your responsibilities in the planning stages of a printing job will vary, however you should have an understanding of all the procedures which are used in the planning of a printing job.

PLANNING THE JOB

In many cases, the PO in C is given only an idea of the job and told to decide on the specifications himself. In these cases, he reads the copy to determine its subject matter and then lays it out in the form that he feels is most fitting.

A short announcement may be presented as a bulletin or letter; a lengthy article may be made into a pamphlet or booklet. The purpose of the job is the important factor in determining its proper physical form.

The PO in C must also decide whether the job will be printed letterpress or offset, the kind of paper stock to be used, and the size and shape of the page.

In determining the dimensions of a job, he must always keep in mind the size of the paper stock available, the size of the press, and the binding operations which follow. For purposes of economy, he should try to select a page size that will cut out of the stock sheets with the least amount of waste. It is frequently possible to print two or more pages at a time on the same sheet, but he must always keep in mind the capacity of the equipment when he is planning such a job so that he won't come up with something too large to be handled in his shop.

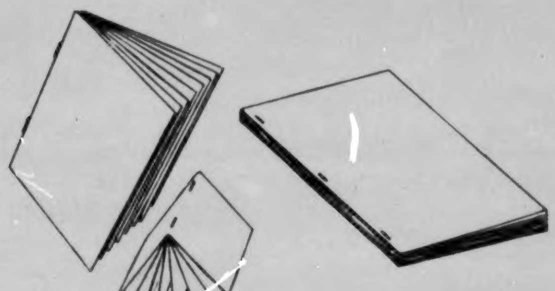
He must also be on the alert for jobs that are too small for the press. The smaller presses (up to size 10" X 15") will take a sheet as small as 3" X 5", but larger presses require a sheet at least 8" X 10". You could run a 3" X 5" job on one of the larger presses, but you would have to print it on a 8" X 10", sheet and consequently there would be a good deal of waste.

To prevent such waste, small jobs are generally assigned to the smaller presses, or they are printed two or more up on the large presses. That is, the form is repeated on the plate so that two or more copies can be printed on the paper at each impression. (The forms are cut apart in the bindery later.) Running jobs two or more up in this manner reduces waste and cuts down press time. Sometimes, too, small jobs are ganged or printed together on the same press sheet with other jobs even though the jobs are not related in any way. Ganging is discussed in detail in chapter 9 of this manual.

A sheet of paper with a number of pages printed on it is called a signature. When a signature leaves the pressroom, it is taken to the bindery and folded so that all the pages are in their proper order. If a booklet contains more than one signature, the signatures are assembled in sequence and bound together.

When four or more pages are printed on the same sheet, the sheet can be folded and stapled along the fold, as shown in figure 2-1. This is known as saddle stitching. Saddle stitched books should be planned in multiples of four pages to avoid the occurrence of blanks.

If the pages of a booklet are printed singly, the sheets are generally bound in loose-leaf binders or stitched along the edge (side stitched), as shown in figure 2-1.



Saddle stitched books are stitched along their fold.

Side stitched books are stitched flat along the edge.

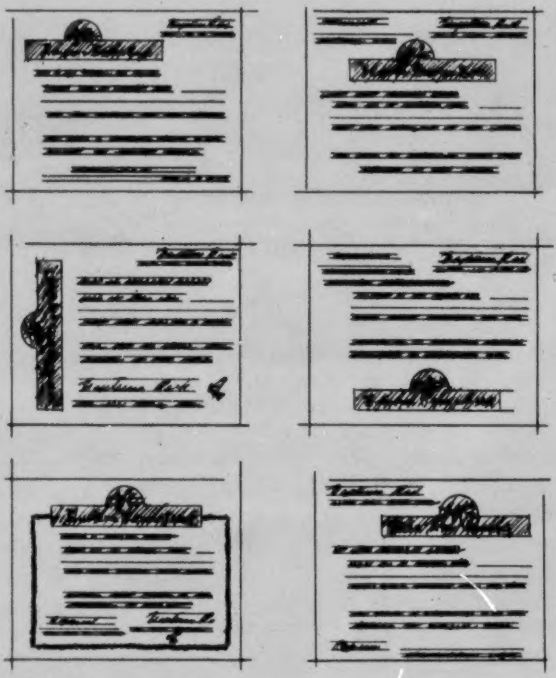
57.20

Figure 2-1.—Comparison of side and saddle stitching.

The Layout

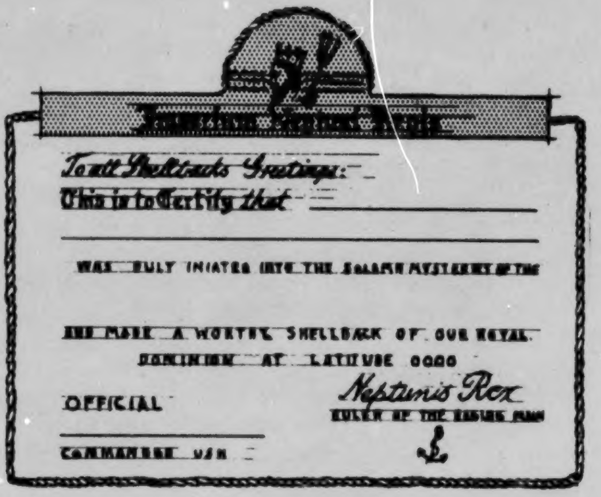
Simply stated, a layout is the plan of a job. The layout shows the arrangement of the type matter and the position of the illustrations. The first step in an original job is to prepare the layout.

The early stages of a layout are in the form of rough preliminary drawings or sketches. Figure 2-2 illustrates a series of these sketches. When one sketch seems to best fulfill the requirements of the job, it is drawn to the exact size required. Copy proportions, rules, and boxes should be clean and definite. (See figure 2-3.) Illustrations and photograph areas should be clearly indicated as shown in figure 2-4.



57.21

Figure 2-2.—A series of thumbnail sketches. They should be drawn with a minimum of detail.



To all Shellbacks Greetings:

This is to Certify that

WAS DULY INIATED INTO THE SOLEMN MYSTERIES OF THE

AND MADE A WORTHY SHELLBACK OF OUR ROYAL DOMINION AT LATITUDE 0000

OFFICIAL

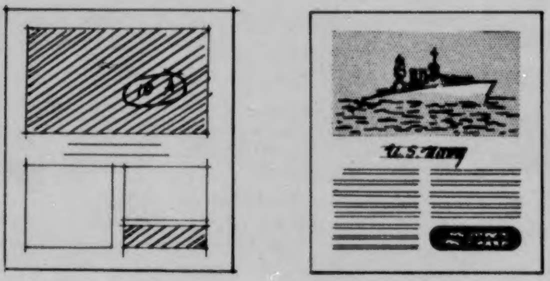
Neptunis Rex

RULER OF THE RAGING MAIN

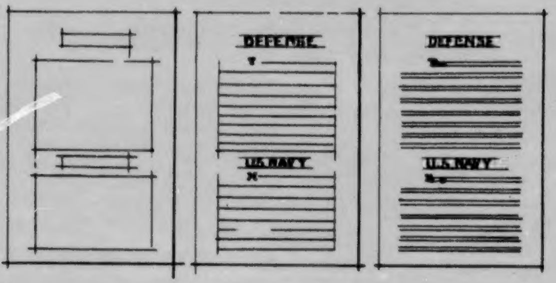
COMMANDER USN

57.22

Figure 2-3.—Finished rough for a small job.



57.23
Figure 2-4.—Methods of indicating areas for illustrations on a dummy.



57.24
Figure 2-5.—Methods of indicating type matter areas on a dummy.

In addition to giving the personnel in the shop a plan of the job, the layout also provides the originator of the job a detailed sketch which enables him to visualize the appearance of the job when it is completed. Changes to the layout save manhours and materials as opposed to changes which are made after production begins.

Making a Dummy

A rough layout, like that shown in figure 2-3, is generally sufficient for a small job, but booklets or pamphlets sometimes require that a dummy be prepared to show their page by page content in rough visual form. A dummy is a book of blank pages ruled to scale to show the position of type and illustrations. (See fig. 2-4.)

Just how detailed the dummy should be depends upon the immediate circumstances. Sometimes a very rough layout is ample if your shop is small and the different departments work closely together. But in any case, a fairly complete layout leaves less room for anything to go wrong along the line.

There are several ways of indicating type areas on the dummy. One of the simplest methods is to rule a square or rectangle on the page to show where the type is to go. Another method is to rule in a series of lines, as shown in figure 2-5. Wide lines are used for large type and narrow lines for small type. If proofs from type are available, they are sometimes pasted in place on the dummy to show the location of the type on the page.

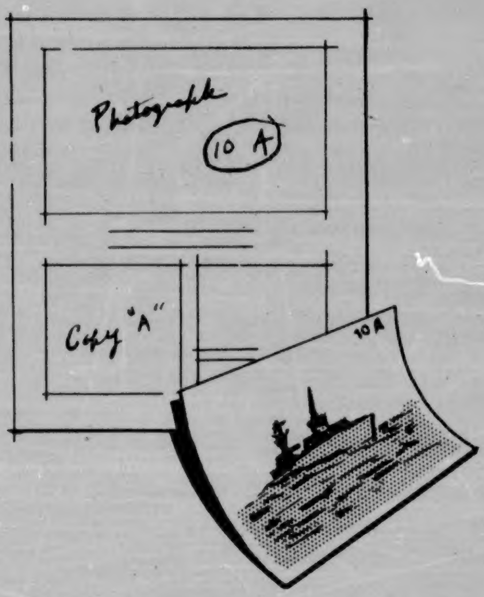
When proofs or reproductions of illustrations are available, they may also be pasted in the proper positions on the dummy. However, it is generally sufficient to rule in an outline and indicate the photograph or illustration that is to go there, as shown in figure 2-4.

Certain kinds of work, such as photographs and water color (wash) drawings are known as tone work. Tone work must be photographed by a special process, as you will see later in this book. It is not shot on the same negative with type or line drawings. Sometimes, too, parts of the line copy are shot separately so that they can be reduced to fit into a given space. The photographic negatives of such copy are fitted or "stripped" into the master negative. When small negatives are stripped into larger ones, they are called inserts or strip ins. The size and position of inserts should be carefully marked on the dummy.

Marking the Dummy

When the dummy has been completed, it must be marked to show type sizes, styles, inserts, rule weights, and so on. These markings should be done in red to avoid confusion with the pencil lines on the layout.

The width and depth of type areas and areas for illustrations should be clearly indicated on the dummy. An identifying number or letter should also be marked on the copy or art and its corresponding position on the dummy. (See fig. 2-6.) Avoid placing the identification number or crop marks in the image area of the copy or artwork.

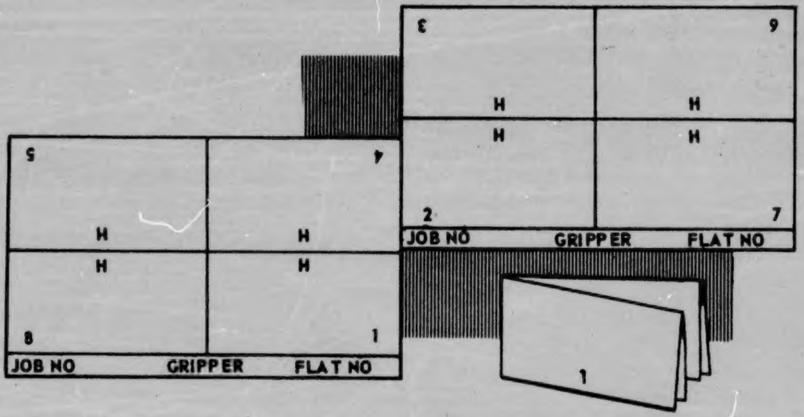


57.25
Figure 2-6.—Photographs should be marked on the back or along the margin. The dummy has a corresponding marking.

Although dummies like those just described are usually prepared in larger shops, in the average shipboard shop, the PO in C generally prepares a press layout sheet rather than a finished dummy. (See fig. 2-7.) This sheet consists of a blank sheet of stock of the same kind and size as the sheet to be used in printing the job. It is folded just as it will be in the bindery after printing and the pages are numbered in the proper sequence to show the arrangement of the pages on the plate. It sometimes shows the location of the printed matter and provides other information, such as margins, cut marks, back-up, signature marks, and so on.

Specification Sheets

The overall specifications, such as the paper to be used, the color of ink, the number of plates, and other necessary information, are generally indicated on a specification sheet which is then attached to the job. The specification sheet contains all the information that each department or individual needs to do the job. In many shops the spec sheet also serves as the job order. These sheets should be prepared in duplicate so that one copy can accompany the job and one can be kept for filing. Whenever possible, it is best to enclose the dummy and copy in a large envelope to protect them and to facilitate handling. The specification sheet can be attached to, or printed on the outside of the



57.26

Figure 2-7.—Press layout sheet.

envelope so that the job can be readily identified.

In a later chapter you will find an expanded discussion on specification sheets, job orders, and job controls.

SELECTING THE TYPE STYLE

Some type faces seem to fit almost any kind of job, while others are suitable only for special types of work. There are no hard and fast rules, of course, that say that one style is right and another wrong. The use of type is governed entirely by good taste and association. But to choose type wisely, you must be able to recognize the different type faces and to know something of their general usage.

Meet the Type Faces

Did you ever stop to think how many different kinds of handwriting you come across in a single day? Some are large and bold; some are weak; some small; some clear—and some are almost illegible. Type styles (called type faces) are much the same.

The first concern of a printer in selecting a type is, of course, clarity. Type must be legible to be read. But there is more to it than that. Like handwriting, type faces reflect certain characteristics, such as refinement, dignity, boldness or strength. Properly used, they can convey the feeling or mood of a message. They may be warm, brisk, dignified, modern, or old-fashioned—whatever is needed to emphasize or suggest the thoughts expressed in the copy.

Printers have also learned to use type to attract the reader's attention. The use of large, bold faces is one of the most effective ways of stopping the eye. But large, bold type is difficult to read. It should be limited, to a few words of copy, and it should be followed by small, legible faces that invite reading.

Resemblances and Differences

There are thousands of type faces, and learning to recognize them is like learning to recognize ships and aircraft—each has its own distinct characteristics.

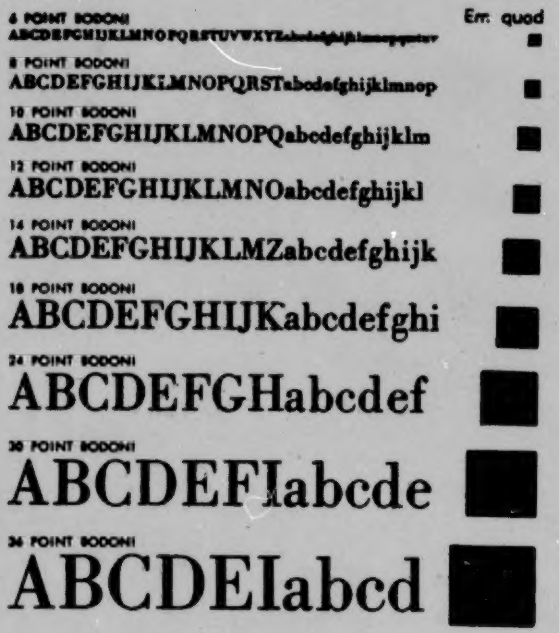
The first distinction is to be made between capital letters and small letters. Capitals are usually called caps or uppercase, and the small letters are always called lowercase. This designation dates back to the days before automated type setting, when all composition for newspapers and books was done by hand. Since a great deal of type was required, it was divided between two cases which were placed on a stand. The top or upper case contained all the capital letters and the bottom case contained the small letters.

Type is further classified according to its size and the style of letter that it carries. It comes in various sizes. The usual distinction is between big letters (called display or headline type) and the small sizes (called body or text type). However, printers have a system of measurement that identifies type a great deal more closely than that. Printer's measurements are based on the point system. The point is approximately 1/72 of an inch long, and when one speaks of 8 or 12-point type, he simply means that the body of the type measures 1/9 or 1/6 of an inch from front to back. Of course, the type face itself is seldom as large as the body, because a small shoulder or ledge is left below the letter on most type.

Metal type sizes range from 3- to 120-point, but the sizes shown in figure 2-8 are those most commonly used. You will notice that the faces shown in the illustration are exactly alike in design; they vary only in size. Different sizes of the same type face are known as a type series.

Type faces which are similar, though not exactly alike in design, are generally grouped in another classification called families. Each family has a name and certain basic family resemblances. Some families include dozens of type faces all different in some way, yet all having general characteristics that unmistakably identify them as members of their particular family.

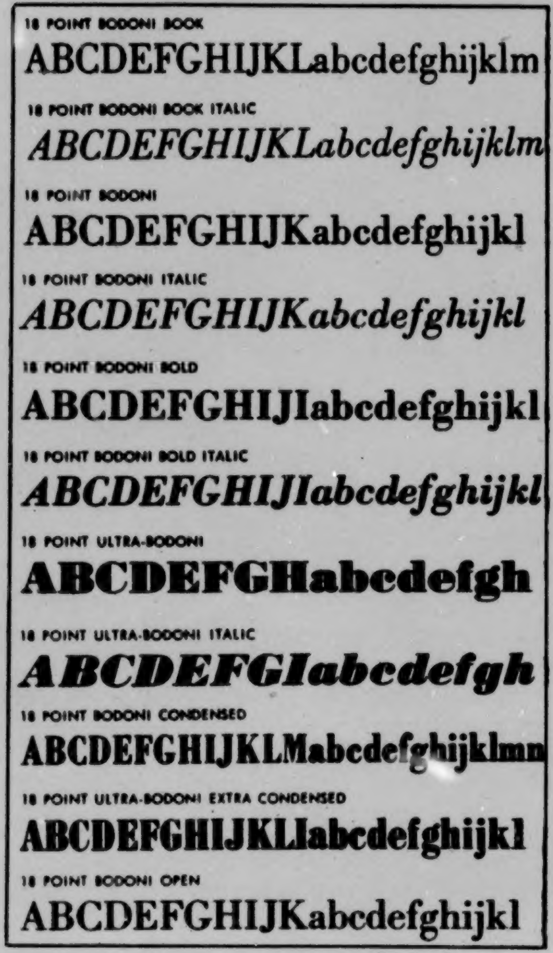
Take the Bodoni type shown in figure 2-9, for example. All Bodoni type is made up of a combination of thick and thin lines; yet all Bodoni is not alike. The thickness of the heavy lines varies. There is a light face called Bodoni Book; the regular face, called simply Bodoni; a heavier face, called Bodoni Bold; and a very fat face, called Ultra-Bodoni. There are also


Em quad
6 POINT BODONI
ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuv
8 POINT BODONI
ABCDEFGHIJKLMNOPQRSTabcdefghijklmnop
10 POINT BODONI
ABCDEFGHIJKLMNOPQabcdefghijklm
12 POINT BODONI
ABCDEFGHIJKLMNOabcdefghijkl
14 POINT BODONI
ABCDEFGHIJKLMZabcdefghijk
18 POINT BODONI
ABCDEFGHIJKabcdefghi
24 POINT BODONI
ABCDEFGHabcdef
30 POINT BODONI
ABCDEFIabcde
36 POINT BODONI
ABCDEIabcd

45.207(57)A

Figure 2-8.–A type face is classified according to its style and size. Shown here is a type style in various sizes.

condensed faces of corresponding thickness of line, but of narrow width. Then there are expanded faces, again of corresponding thickness, but stretched to extra width. Some families have literally scores of different faces.


18 POINT BODONI BOOK
ABCDEFGHIJKLabcdefghijklm
18 POINT BODONI BOOK ITALIC
ABCDEFGHIJKLabcdefghijklm
18 POINT BODONI
ABCDEFGHIJKabcdefghijkl
18 POINT BODONI ITALIC
ABCDEFGHIJKabcdefghijkl
18 POINT BODONI BOLD
ABCDEFGHIJIabcdefghijkl
18 POINT BODONI BOLD ITALIC
ABCDEFGHIJIabcdefghijkl
18 POINT ULTRA-BODONI
ABCDEFGHabcdefgh
18 POINT ULTRA-BODONI ITALIC
ABCDEFGIabcdefgh
18 POINT BODONI CONDENSED
ABCDEFGHIJKLMabcdefghijklmn
18 POINT ULTRA-BODONI EXTRA CONDENSED
ABCDEFGHIJKLIabcdefghijkl
18 POINT BODONI OPEN
ABCDEFGHIJKabcdefghijkl

45.207(57)B

Figure 2-9.–Some type faces from the Bodoni family.

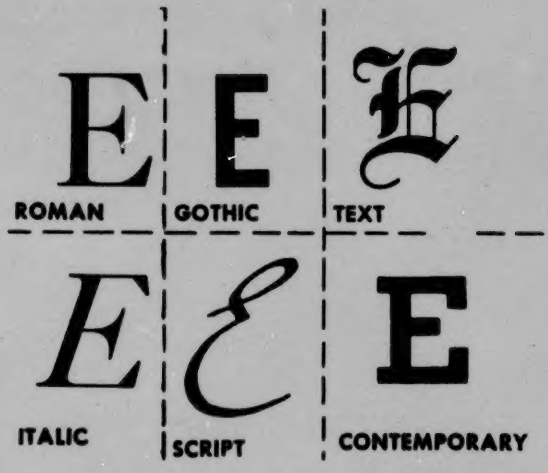
THE SIX CLASSES OF TYPE

Besides the series and families, there is still another classification of type. It is generally divided into six groups: roman, gothic, script, text, italic, and contemporary. All authorities do not agree on this grouping, but for practical purposes, this book will discuss type faces under these six main categories. (See fig. 2-10.)

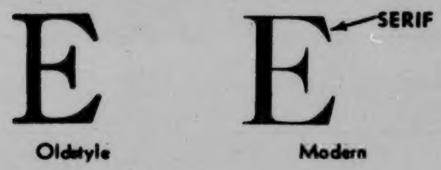
Roman

Roman is the type most commonly used for the text of magazines, newspapers, and books. It is chosen because everyone is familiar with it and because it is the easiest to read in the smaller sizes and in lengthy articles.

Roman types are divided into two classifications: modern and oldstyle. The chief difference between modern and oldstyle roman is found in the serifs. (Serifs are the little cross-strokes at the ends of the main lines.) Compare the two letters shown in figure 2-11. You will notice that the oldstyle letter has soft, rounded, serifs, while the modern letter has heavier shadings and thin,

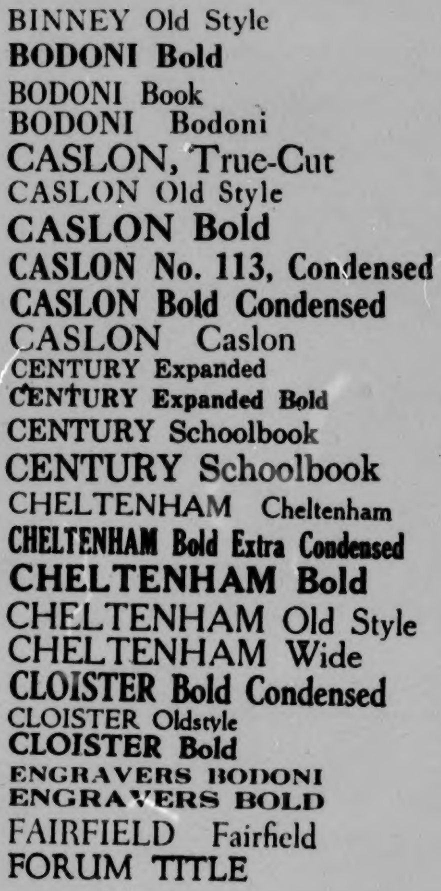


45.207(57)C
Figure 2-10.—The six main classes of type.



45.207(57)D
Figure 2-11.—Comparison of oldstyle and modern roman letters.

clean-cut hairlines. Bodoni is typical of modern roman and Caslon is a good example of the oldstyle faces. (See fig. 2-12.) Roman faces can be used for any kind of work, but printers generally try to avoid mixing the oldstyle faces with the modern.


BINNEY Old Style
BODONI Bold
BODONI Book
BODONI Bodoni
CASLON, True-Cut
CASLON Old Style
CASLON Bold
CASLON No. 113, Condensed
CASLON Bold Condensed
CASLON Caslon
CENTURY Expanded
CENTURY Expanded Bold
CENTURY Schoolbook
CENTURY Schoolbook
CHELTENHAM Cheltenham
CHELTENHAM Bold Extra Condensed
CHELTENHAM Bold
CHELTENHAM Old Style
CHELTENHAM Wide
CLOISTER Bold Condensed
CLOISTER Oldstyle
CLOISTER Bold
ENGRAVERS BODONI
ENGRAVERS BOLD
FAIRFIELD Fairfield
FORUM TITLE

45.207(57)E
Figure 2-12.—A few of the roman type faces.

Gothic

Study the difference between the roman letter and the gothic letter shown in figure 2-10. You will notice that where the roman letter is composed of a series of thick and thin lines, the gothic letter is constructed of lines of even weight. It has no serifs; it is perfectly plain. It might be called a block letter. Figure 2-13 shows some of the gothic types. The sans serif included in the illustration is an up-to-date style of gothic. However, because of its modern design, it is generally grouped, not with the gothics, but with the contemporary type faces.

As you will see in figures 2-13 and 2-14 there are several kinds of gothic type faces. Each has its place in modern printing. Copperplate Gothic, for example, is generally used for letterheads, envelopes, cards, announcements and many kinds of office forms.

News Gothic is another serviceable face. It may be used as a body type, and it is equally serviceable for titles and headings. Franklin Gothic, Alternate Gothic, and Poster Gothic are used chiefly for display work. They are very popular for posters and headings.

CONDENSED TITLE GOTHIC NO. 11
BANK GOTHIC CONDENSED BOLD
FRANKLIN Gothic Extra Condensed
POSTER GOTHIC
FRANKLIN Gothic Condensed
RAILROAD GOTHIC
BANK GOTHIC CONDENSED MEDIUM
NEWS Gothic
GOTHIC NO. 520 TO 526
LINING Gothic No. 545
ALTERNATE Gothic No. 1
ALTERNATE Gothic No. 2
ALTERNATE Gothic No. 3
NEWS Gothic Extra Condensed
SANS Serif Bold
COPPERPLATE GOTHIC BOLD NO. 132
GOTHIC No. 544
NEWS Gothic Condensed
GOTHIC No. 3 Gothic No. 3
COPPERPLATE GOTHIC NO. 342, HEAVY
LINING PLATE GOTHIC, HEAVY
COPPERPLATE GOTHIC CONDENSED NO. 129, HEAVY
GOTHIC No. 32 (LIGHT COPPERPLATE)
GOTHIC No. 31 (BOLD COPPERPLATE)
GOTHIC NO. 521, CONDENSED
GOTHIC Condensed No. 49
COPPERPLATE GOTHIC EXTENDED
COPPERPLATE GOTHIC CONDENSED NO. 343, HEAVY
GOTHIC No. 6 Gothic No. 6

45.207.(57)F

Figure 2-13.–A few gothic type faces. Alternate and Copperplate Gothics have wide use in standard Navy forms.

Script

Script and cursive type faces are generally grouped together. Scripts have little connecting links or kerns that combine the letters and give them the appearance of handwriting; cursive letters do not have these kerns. Actually the scripts are an imitation of the old Spencerian handwriting, and the cursives are patterned after old-fashioned hand lettering.

Script faces are extremely suitable for announcements and invitations. They may also be used to impart an air of elegance and charm to display work.

Figure 2-15 shows a few of the script type faces. You will notice that some of the faces shown are contemporary styles used in modern display work.

Text

Samples of test type faces are shown in figure 2-16. You may know this type simply as "Old English." Text was among the first type styles used. In fact, Gutenberg worked almost exclusively with this style of type. Although it is still used frequently, it is generally limited to a few lines of copy. You should save it for something religious or formal, such as prayer books, programs, and invitations.

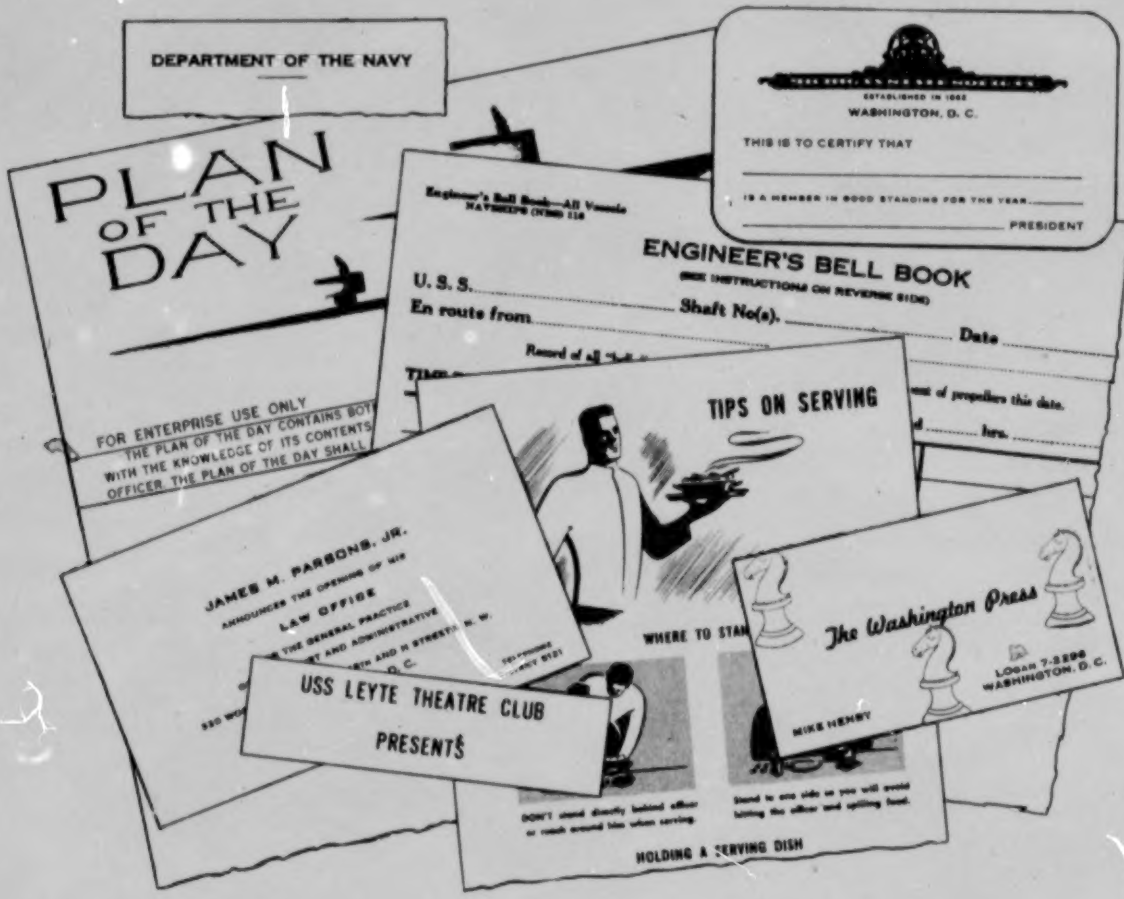
Italics

Italics are slanting letters like those shown in figure 2-17. They are made to match almost every roman, gothic, and contemporary type style in use today. They are used in text matter to show emphasis and in display work to create contrast and to add interest to the job. Although italics were originally used for text they were rather hard to read in lengthy articles, and so they have been used less and less for this purpose, until today they are used rather sparingly.

Swash letters are similar to italics, but they are embellished by additional swirls and curves, known as swashes. You can sometimes use them with italics to dress up a page which otherwise might be bare and unattractive.

Contemporary Faces

The past forty years have been significant in typographical history. The old gothics have had their faces lifted, and everywhere new streamlined faces have appeared. Naturally many of these modern faces are fads. Their style and usefulness will be short-lived. Out of it all, however, have come a few serviceable type faces that will take their place alongside the old standby's we've been discussing.


DEPARTMENT OF THE NAVY
PLAN OF THE DAY
FOR ENTERPRISE USE ONLY
THE PLAN OF THE DAY CONTAINS BOTH
WITH THE KNOWLEDGE OF ITS CONTENTS
OFFICER. THE PLAN OF THE DAY SHALL
WASHINGTON, D. C.
THIS IS TO CERTIFY THAT
PRESIDENT
ENGINEER'S BELL BOOK
U. S. S.
Shaft No(s).
En route from
Date
TIPS ON SERVING
HOLDING A SERVING DISH
JAMES M. PARSONS, JR.
LAW OFFICE
USS LEYTE THEATRE CLUB
PRESENTS
The Washington Press
WASHINGTON, D. C.
MIKE HENRY

45.207(57)G

Figure 2-14.—Some uses of Gothic type faces.

Leading the contemporary field are two distinct styles: the square serif and the sans serif.

Sans serif, as you have already seen is actually a kind of gothic type. It has the same even strokes as the gothic, and it has no serifs. But unlike its gothic ancestors, it has such perfect geometric proportions that it is generally classified with the contemporary type faces.

Study the Futura type faces shown in figure 2-18 for a moment. Notice that the letters seem to be constructed from squares, rectangles, and other geometric forms. This type face is the last word in simplicity, yet it is one of the most serviceable of all the type faces the modern printer has at his disposal. It can be used almost anywhere.

Square serif is little more than sans serif with serifs added. It has the same even strokes and the same perfect geometric proportions. Square serif type originated in Europe shortly after the sans serif faces made their appearance. It became popular in the United States in the early thirties. Some people think it is an off-spring of the old Egyptian alphabet. Others believe it was inspired by typewriter type which was widely employed by advertisers of that period. Stymie is a typical example of this type. (See fig. 2-19.)

Contemporary display faces is a classification which includes hundreds of modern type faces used in display work today. There are so many of them, that it would be difficult to try to list them all. There are a number of scripts and italics, for example, which can be identified by their streamlined appearance. The Kaufman shown in figure 2-15 is one of these modern scripts. Others include Brush and Gilles Gothic.

There are also a number of tall, condensed types, such as Onyx and Valiant. Then there are wide, bold faces, such as Venus Extrabold Extended. And in between, there are medium faces, such as Lydian and Studio. These types are used chiefly for display composition. (See fig. 2-20.)

ORNAMENTATION AND BORDERS

Initial letters are large, capital letters that are sometimes used at the beginning of a paragraph to dress up the page. They come in all sorts of styles.

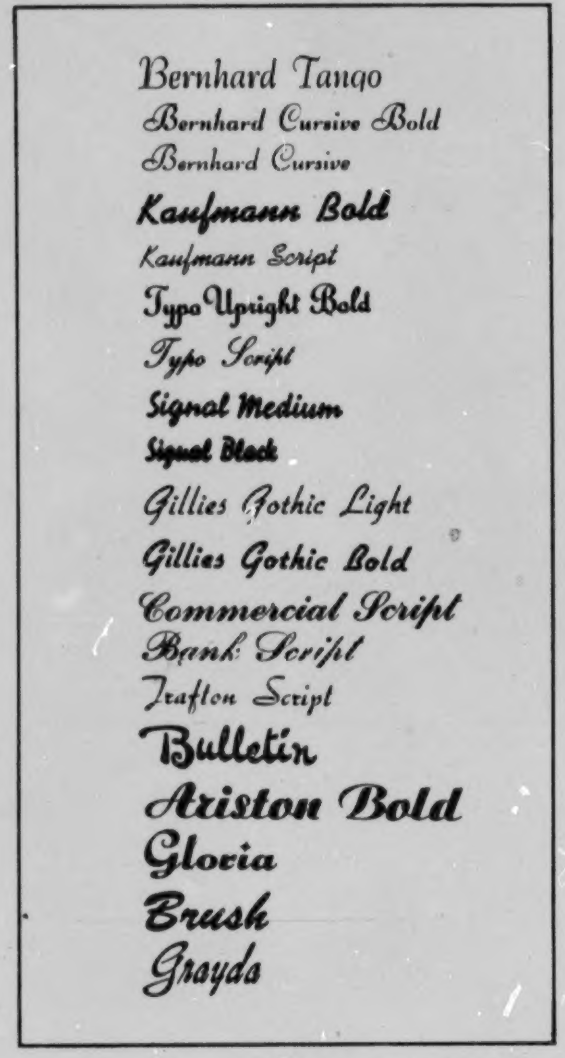
When an initial letter is used, the remainder of the word is generally capitalized. You may use either regular capital letters or slightly smaller capitals of the same style of type. These small capitals are called small caps. Small caps may also be used instead of italics to emphasize words or phrases in the text of books and manuals. (See fig. 2-21.)

Ornaments, such as stars (called dingbats) and dots (called bullets), are used to add interest and beauty to a job. When you use ornaments, you should always select something that goes well with the style of type that you are using. Above all, don't overdo them. Fancy types and decorations should be used only if they make the word more effective. Decoration, just for decoration's sake was abandoned at the turn of the century in favor of simple harmony and balance. (See fig. 2-22.)

Borders and Rules

Borders should be selected with the same care that is used in selecting a type face, because the same general principles of typography apply. You will find that different borders go with different type faces, just as certain type faces go together. One type of border, called a scotch rule, is made up of one heavy line and one thin line. The scotch rule is ideally used with the Bodoni type face because their elements are the same—a heavy and a thin line.

The various lines used within a printed page are called rules. Rules may be used to separate


Bernhard Tango
Bernhard Cursive Bold
Bernhard Cursive
Kaufmann Bold
Kaufmann Script
Typo Upright Bold
Typo Script
Signal Medium
Signal Black
Gillies Gothic Light
Gillies Gothic Bold
Commercial Script
Bank Script
Trafton Script
Bulletin
Ariston Bold
Gloria
Brush
Grayda

45.207(57)H

Figure 2-15.—Script type faces.

Engravers Old English Bold
Engravers Old English Open
Engravers Old English
Engravers Text
Wedding Text Shaded
Wedding Text
Inland Copperplate
Tudor Black No. 2
Typo Text
Cloister Black
Modern Text
Shaw Text
American Text

45.207(57)J
Figure 2-16.—Text type faces.

sections of a page, to guide the reader's eye, or serve as writing lines.

A rule primarily used for a writing line is called a hairline rule. A medium rule is used for dividing sections of a form. A heavy rule is used to add special emphasis to a section and is generally used for the first and last lines of a form. Figure 2-23 illustrates the various rule sizes, which are referred to as line weights.

The selection of rules is important to the overall legibility of your work. Too many rules, or rules which are too heavy, tend to make a printed page or form difficult to read.

Legibility

You have already seen that type must be legible to be read. A newspaper printed in Old English or some equally illegible type would probably blind half of its readers—or at least, wear them out. Many of the early type faces have been abandoned because they were too hard to read. The trend today is toward legibility.

BENEDICTINE Book Italic
FUTURA Bold Condensed Oblique
FUTURA Medium Oblique
STYMIE Black Italic
SPARTAN Medium Italic
GARAMOND Bold Italic
GOUDY Handtooled Italic
COPPERPLATE GOTHIC ITALIC
BOOKMAN Old Style Italic
CHELTENHAM Bold Italic

45.207(57)K
Figure 2-17.—Italics are made to match many of the type faces in use today.

Type Style and Size

There are certain factors that help you attain legibility, just as there are factors that hinder it. The style of letter that you use is important. The simpler it is, the easier it will be to read. Open, clean-cut letters with plain serifs are best. The serifs lend unity to the words, binding them together for easy reading.

The size of the type also affects legibility. If you have ever tried to read the small print on a contract, you know that it is almost impossible to read the smaller sizes of some type faces. Eight- to fourteen-point type is considered to be the most legible. Larger or smaller sizes are generally more difficult to read.

Length of Line

The length of the line also affects the ease with which the material can be read. You will find that 2-to 3-inch columns are generally used for 8-point type and 2- to 5-inch columns, for 10-point type. The length of the line should be reduced or increased in proportion to the size of the type used.

SANS Serif Extra Bold
SANS Serif Extra Bold Condensed
SANS Serif Medium Condensed
SANS Serif Light
SANS Serif Medium
20th CENTURY Ultrabold
20th CENTURY Extra Bold
20th CENTURY Ultrabold Condensed
20th CENTURY Extra Bold Condensed
20th CENTURY Medium Condensed
20th CENTURY Bold
20th CENTURY Medium
FUTURA Bold Oblique
FUTURA Display
FUTURA Bold
FUTURA Demibold
FUTURA Bold Condensed
FUTURA Medium
FUTURA Medium Condensed
KABEL Light
KABEL Medium
KABEL Bold
SPARTAN Medium
SPARTAN Black

45.207(57)N
Figure 2-18.–San serif type faces.

STYMIE Light
STYMIE Extra Bold
STYMIE Bold
STYMIE Medium
STYMIE Extra Bold Condensed
BAUER BETON OPEN
BAUER Beton Bold
GIRDER Heavy
KARNAK Medium

45.207(57)P
Figure 2-19.–Square serif type faces.

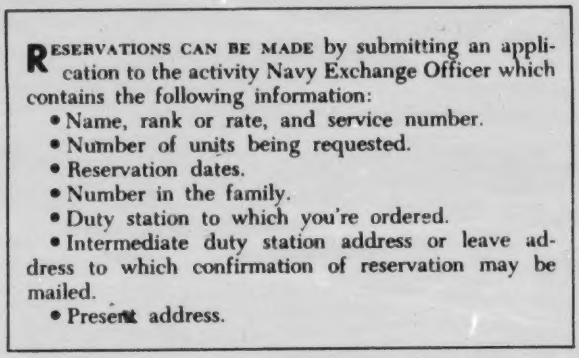
Lydian Cursive
BALLOON BOLD
OFFENBACH MEDIUM
VALIANT Valiant
ONYX Onyx
CARTOON BOLD
PLAYBILL
LYDIAN Bold
FLASH Bold
Dom Casual
Trend
Studio
Venus X-B Extend.

45.207(57)Q
Figure 2-20.–Contemporary display type faces.

The length of lines is always measured in picas–another printer's measure. The pica is equal to 12 points, and there are approximately 6 picas to the inch. Therefore a line of type 3 inches long is said to be 18 picas long. Printers use a ruler called a line gage for measuring lengths. (See fig. 2-24.) It is marked in inches on one side and in picas on the other so that you can measure dimensions either way.

Spacing Between Lines

The amount of spacing between the lines is another factor that affects legibility. In general, more space should be used between long lines

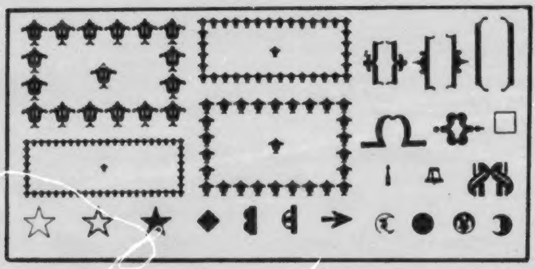


RESERVATIONS CAN BE MADE by submitting an application to the activity Navy Exchange Officer which contains the following information:

- Name, rank or rate, and service number.
- Number of units being requested.
- Reservation dates.
- Number in the family.
- Duty station to which you're ordered.
- Intermediate duty station address or leave address to which confirmation of reservation may be mailed.
- Present address.

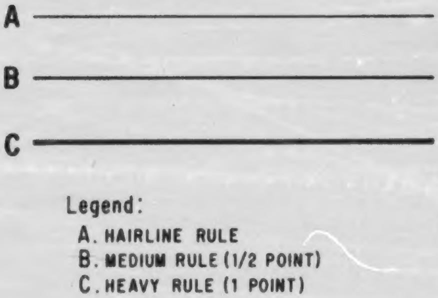
57.693

Figure 2-21.—Initial letters, small caps, and ornaments are used to attract attention.



57.17

Figure 2-22.—Ornaments and borders.



57.694

Figure 2-23.—Comparison of rule weights.

than between short lines. Certain type faces also call for wider spacing between the lines than others.

The space between the lines is called "leading," pronounced led-ding. The term leading derives from the thin metal strips used by the hand-set type compositor to separate the lines of type. The space between the lines is measured in points.

Spacing Between Words

Proper spacing between words is still another key factor in obtaining legibility. You must use sufficient space between the words to prevent them from running together.

In hand-set composition, blank pieces of type are used to space between words. Cold type composition equipment usually has two spacing keys, either of which may be used depending upon the amount of space required.

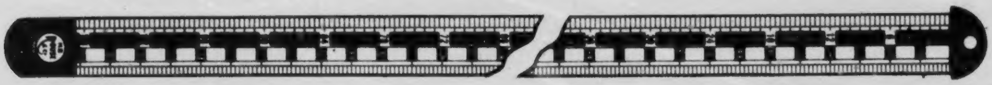
Letterspacing

Certain type faces, primarily large display faces, are more legible if space is added between the individual characters. This technique is called letterspacing. In figure 2-25, you can see how letterspacing increases legibility.

ADDITIONAL LEGIBILITY FACTORS

Other factors which affect legibility are listed in the following paragraphs:

1. Caps and lowercase letters are more legible than lines set in all caps. Words set in all caps in a script or text type face are almost illegible. (See figure 2-26.)
2. Oldstyle roman faces are more readable and easier on the eyes than modern roman faces.
3. Medium faces are more legible than condensed or expanded faces, particularly in the smaller sizes.
4. Expanded faces are more readable than condensed faces, but they take up more room and are sometimes not worth the difference.
5. Condensed faces are more practical than expanded type for display work, because more characters can be placed in a line and the type is large enough that there is no appreciable loss of legibility.



57.18

Figure 2-24.—The line gage.

CHANGE OF COMMAND

CHANGE OF COMMAND

45.207(57C)A

Figure 2-25.—Letterspacing of large display type faces increases legibility.

6. Ample white space (margins) make a page more readable.

7. Paragraphs and indentions help to break up the page and increase legibility.

8. Different type faces should be mixed sparingly; it is better to use different sizes of the same type face or a different type series within the family than to mix a variety of type families.

SUMMARY

Work that is sent to your shop which is a reprint of a job, requiring no changes or corrections, is termed "camera-ready".

New or original jobs require several steps of job planning and copy preparation. These steps may include the following: preparing a layout, making a dummy, selecting type styles, composition of the type matter, ruling, and preparing the artwork. The size and complexity of the job determines whether all the steps are necessary.

The layout shows the arrangement of the type matter and the position of the illustrations. It is the first step taken in planning a job.

A dummy is generally prepared for multiple page booklets. It is in the form of blank pages ruled to scale with markings which indicate type sizes and styles, rule weights, and other pertinent information.

The selection of the type size and style is important to each job. Legibility is the first concern when making a type selection.

Type styles are grouped into six classifications: roman, gothic, script, text, italic, and contemporary.

The selection of rules, borders, and ornaments are as important to a job as the type selection. Certain rules, borders, and ornaments go with certain type faces, just as different type faces go together.

There are many factors which determine the legibility of a printed page. The size and style of the type, the length of the lines, and the amount of spacing between the words and lines are all legibility factors.

Change of Command Ceremony

CHANGE OF COMMAND CEREMONY

45.207(57C)B

Figure 2-26.—Script and text type styles set in caps lose legibility.

CHAPTER 3

COLD TYPE COMPOSITION

Material which is to be printed is generally referred to as "copy." Copy which is produced by methods that do not include the use of metal type or slugs is known in the trade as cold type copy or cold type composition. Phototypeset copy obtained from the Headliner and typewritten copy from such machines as the IBM Proportional Spacing Machine, the IBM Selectric Composer, the Justowriter, and the VariTyper are in this category.

This manual was printed by offset lithography from copy which was composed on the Justowriter. After this copy was proofread and corrected, it was photographed to provide the negatives from which the lithographic plates were obtained. The term "reproduction proofs" is generally applied to this type of copy.

As you know, photo-offset printing is done from flat, metal plates rather than from raised surfaces. Since these plates are produced from negatives, it matters little whether the copy consists of reproduction proofs pulled from type, clippings, cold type composition, or phototypeset copy. Any of these media may be used as long as the copy is sharp and black so that it will photograph well.

In this chapter, you will learn the operating features of the most prevalent cold type composing equipment in use in the Navy today. You will also see how the copy is prepared and corrected before it is photographed.

COPY FITTING

It is sometimes necessary to photograph cold type composition on a smaller scale so that it will fit into the space allotted to it. This is known as reducing it. Typewritten copy is frequently reduced by one-third or one-half of its original size.

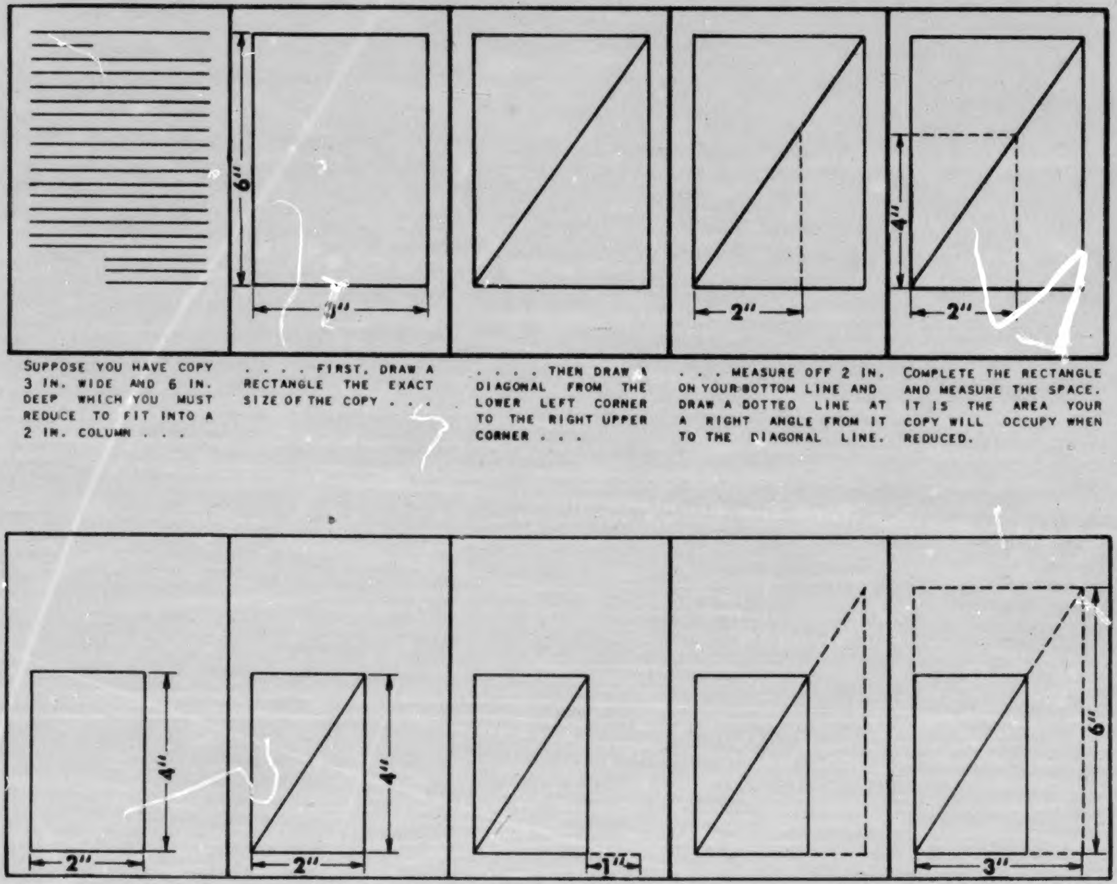
Of course, when you reduce the width of a block of type, you also reduce its height. Therefore, you must plan your work in the proper proportions so that it will come down to the correct dimensions when it is reduced. To find your typing dimensions, you can use a simple plan for proportionate reduction or enlargement. This plan is called "scaling." Figure 3-1 shows how to scale work for enlargement or reduction. As you will see later, this same system can be used for fitting photographs and artwork into the job.

Scaling Wheel

You can also scale copy or art with a scaling wheel, like that shown at the top of figure 3-2. Although the dial of the wheel shown in the illustration contains a number of different scales, it is only necessary for you to use the outer one (Scale C) when scaling copy or artwork. Set the longest pointer (called the cursor) to the number on the scale that corresponds to the actual width of the copy. Once this pointer is set, it will not move when you turn the other pointer. Set the short pointer to the number on the dial that corresponds to the actual depth of the copy.

Next move the long pointer to the number on the scale that represents the new width after reduction or enlargement. (The shorter pointer will turn with the long pointer.) Read the number under the indicator on the short pointer. This number represents your new depth.

An actual example will help to make this clear. Suppose your copy is 40 picas wide and 30 picas deep and you want to reduce it to 20 picas in width. You should set the long pointer at 40 and the short pointer at 30. Then move the long pointer to 20 and read the number



SUPPOSE YOU HAVE COPY 3 IN. WIDE AND 6 IN. DEEP WHICH YOU MUST REDUCE TO FIT INTO A 2 IN. COLUMN . . .

. . . . FIRST, DRAW A RECTANGLE THE EXACT SIZE OF THE COPY . . .

. . . . THEN DRAW A DIAGONAL FROM THE LOWER LEFT CORNER TO THE RIGHT UPPER CORNER . . .

. . . MEASURE OFF 2 IN. ON YOUR BOTTOM LINE AND DRAW A DOTTED LINE AT A RIGHT ANGLE FROM IT TO THE DIAGONAL LINE.

COMPLETE THE RECTANGLE AND MEASURE THE SPACE. IT IS THE AREA YOUR COPY WILL OCCUPY WHEN REDUCED.

SUPPOSE THAT YOU WISH TO TYPE THE COPY ONE-HALF LARGER SO THAT IT CAN BE REDUCED WHEN PHOTOGRAPHED . . .

. . TO FIND YOUR TYPING DIMENSIONS, DRAW A RECTANGLE 2 IN. X 4 IN. AND RUN A DIAGONAL ACROSS IT. . . .

. . . EXTEND THE BASE 1 IN. (½ OF 2 IN.);

. . . DRAW THE DOTTED LINE AT A RIGHT ANGLE TO THE BASE LINE AS BEFORE, AND EXTEND THE DIAGONAL LINE TO MEET IT . . .

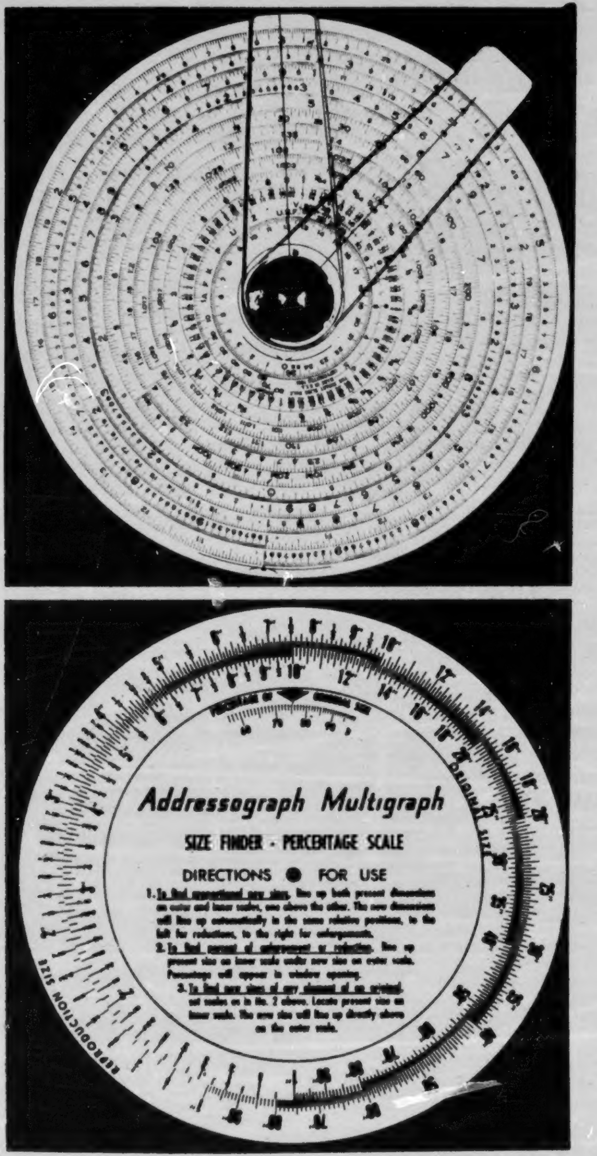
THEN COMPLETE THE RECTANGLE AND YOU WILL FIND YOUR TYPING AREA.

57.15.0:.16.0

Figure 3-1.—Methods of scaling for enlargement and reduction.

under the indicator on the short pointer. You will find this number is 15.

In case you do not have a scaling wheel, like the one shown in the illustration, you may be able to use the scaling wheel that comes with the camera in your shop. The illustration at the bottom of figure 3-2 shows a scaling wheel distributed by the Multigraph-Addressograph Corporation. It consists of two dials joined together in such a manner that the inner dial can be turned. If your copy is 5 inches wide and 10 inches deep and you wish to reduce it to 3 inches in width, you can find your new depth by moving the inner dial until the 5 is alined with the 3 on the outside dial. Then look at 10 on the inside dial. Directly over it on the outer dial you will find the figure 6, which represents the new depth of your copy after reduction.



57.580

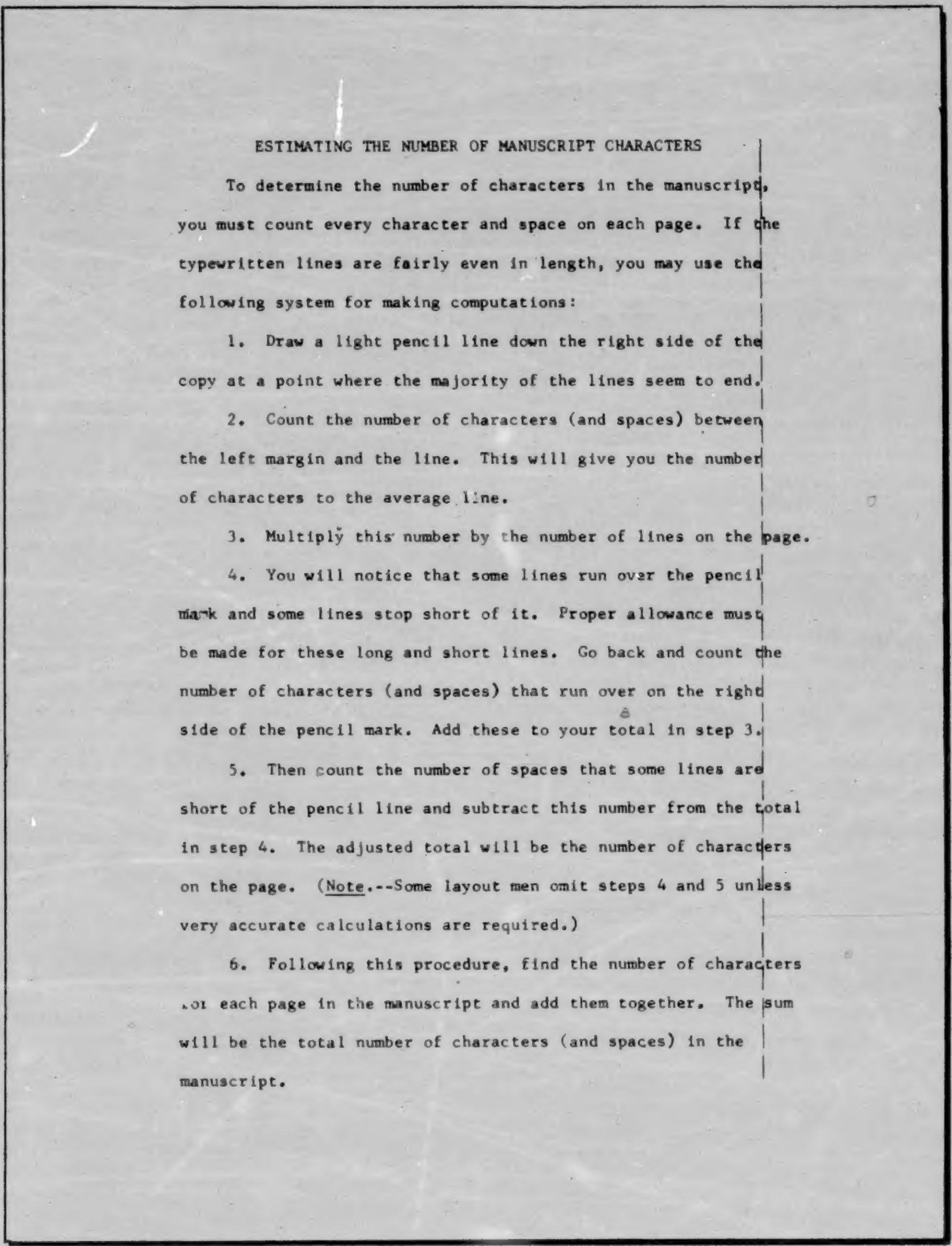
Figure 3-2.—Scaling wheels.

Character Counting

Copy is generally prepared on the regular typewriter before it is set in type or composed on the Varityper or IBM Proportional Spacing Machine. By making a few simple calculations, printers can determine beforehand just how much space the typewritten copy will fill when it is set in letterpress type. You can use the same copy fitting method to find the amount of space that the work will fill when it is produced on the coldtype composing machines.

1. Find the number of characters (and spaces) on each page of the typed manuscript, using the method shown in figure 3-3. After you have found the number of characters (and spaces) on each page, add them all together to get the total number of characters in the manuscript.
2. Next determine the number of characters that will go in one line composed to the proper width in a suitable type face.
    a. Find a printed specimen composed in the size and type style that you wish to use.
    b. On this specimen measure off the width you wish to use and draw a line down the right side, in the manner shown in figure 3-3.
    c. Count the characters (and spaces) in five representative lines to see how many characters occur between the left margin and the pencil line on the right.
    d. Divide the total number of characters found in the five lines by 5 (the number of lines counted). This will give you the average number of characters per line for this style and size of type.
    e. Divide the total number of characters in the manuscript by the average number of characters that will go into one line of type. The result will be the number of lines that the copy will fill.
3. Now determine how many lines (of the selected type size and spacing) will go in 1 inch. Divide this number into the total number of lines to find the length of the copy in inches.
4. Finally make allowances for headings and illustrations in determining the total amount of space that your copy will fill.

If you find that the copy will not fit into the amount of space allotted to it, you may select a smaller type face, vary your spacing, or have the copy reduced. You have seen, in figure 3-1, how



ESTIMATING THE NUMBER OF MANUSCRIPT CHARACTERS

To determine the number of characters in the manuscript, you must count every character and space on each page. If the typewritten lines are fairly even in length, you may use the following system for making computations:

1. Draw a light pencil line down the right side of the copy at a point where the majority of the lines seem to end.

2. Count the number of characters (and spaces) between the left margin and the line. This will give you the number of characters to the average line.

3. Multiply this number by the number of lines on the page.

4. You will notice that some lines run over the pencil mark and some lines stop short of it. Proper allowance must be made for these long and short lines. Go back and count the number of characters (and spaces) that run over on the right side of the pencil mark. Add these to your total in step 3.

5. Then count the number of spaces that some lines are short of the pencil line and subtract this number from the total in step 4. The adjusted total will be the number of characters on the page. (Note.--Some layout men omit steps 4 and 5 unless very accurate calculations are required.)

6. Following this procedure, find the number of characters for each page in the manuscript and add them together. The sum will be the total number of characters (and spaces) in the manuscript.

57.17.0

Figure 3-3.–How to find the number of characters on a typewritten page. Draw a pencil line down at the right side at a point where the majority of the lines end. Then count the number of characters and spaces that occur in the top line between the pencil mark and the left margin. Multiply this by the number of lines on the page. To this total, add the number of characters that extend beyond the pencil line, and subtract the number of spaces that any line is short of the pencil line.

to plan copy proportions when reductions are needed.

There are many other methods of copy fitting. Some operators use plastic scales which they fit against the typed lines; others use copy fitting charts showing the number of characters of each size of type that will go into 1 pica of space and so on. But most of these are simply variations of the process just described.

DIRECT IMAGE MASTERS

As a Navy lithographer, you will find that some of your work is prepared on paper or plastic direct image masters or plates. A direct image master is a plate on which the image is directly applied, bypassing the use of a photographic process.

Direct image masters come in many different sizes, but are primarily used on the smaller presses. They are economical for short-run work and will produce satisfactory copies for many of the jobs sent to your shop.

Preparation of Direct Image Masters

The quality of the copies printed from direct image masters is determined by the way they are prepared. A manual typewriter may be used to prepare them, however an electric typewriter or cold type composing machine is preferred. With electric equipment, the typing pressures are better controlled.

A special grease base (carbon) ribbon must be used to obtain an image on the master which will stand up through the printing process. In addition to the reproducible ribbon, special reproducible pens and pencils must be used if the master is to have a signature or drawing. (Note: Photographs may not ordinarily be reproduced when direct image masters are used.)

When working with these masters, it is important that you keep the composing equipment clean and in good operating order. Otherwise the grease from the ribbon will smear on the master and the finished copies will have a poor appearance. Because of their affinity for grease, direct image masters will also accept the natural oils from your fingers and print them as smudges. Handle the masters along the edges whenever possible.

A soft, greaseless eraser is used to make corrections to direct image masters. A light, lifting stroke with the eraser must be used to prevent the coated surface of the master from being damaged. A faint ghost of the original image remaining after an erasure will not reproduce on the finished copies.

Before starting to type on one of these masters, go over it with a piece of cotton to remove any chalkiness from its surface.

Margins

Direct image masters have printed on them light lines which serve as guide lines to the typist. These guide lines will not reproduce when the master is printed. The guide lines show the relative position of the copy when the job is run on the press. The distance between the line marked "write below this line" and the top edge of the master is known as the gripper margin. No copy can fall within this area because the press grippers overlap the sheet in this space when they clasp it to pull it through the press. You will learn more about gripper margins in a later chapter.

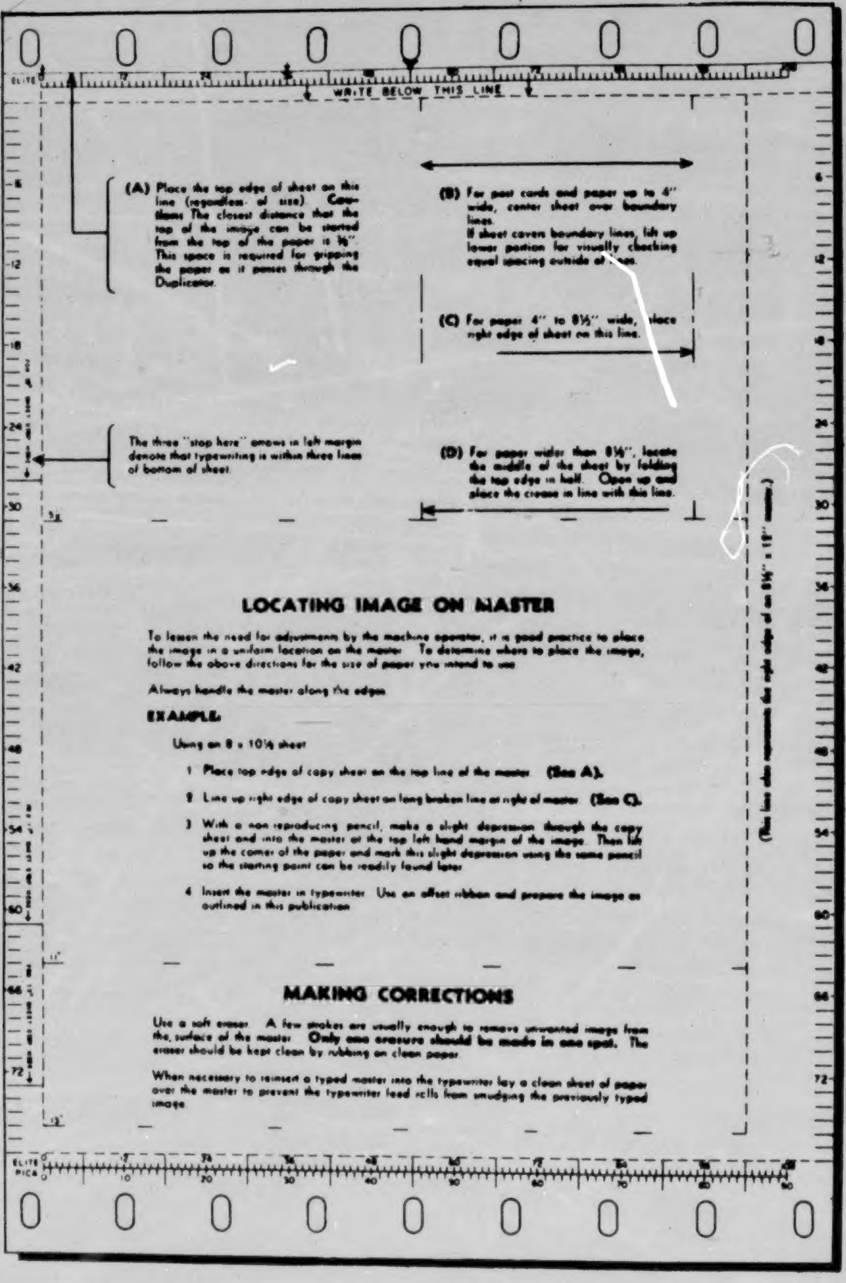
Figure 3-4 illustrates a direct image master which is run on a Multilith offset press.

Drawing

You can draw or letter on paper and plastic plates with crayon, pencil, grease-base ball point pen, or specially prepared inks. When typing and drawing are combined, it is usually best to do the typing first. Proofs from letterpress type may also be pulled on these plates for direct-image reproduction.

THE VARITYPER

The most common cold type composing machine in use in the Navy is the VariTyper, manufactured by the Addressograph-Multigraph Corporation. In this section we will discuss the


ELITE
WRITE BELOW THIS LINE
PICA

(A) Place the top edge of sheet on this line (regardless of size). Cautions: The closest distance that the top of the image can be started from the top of the paper is ⅜". This space is required for gripping the paper as it passes through the Duplicator.

(B) For post cards and paper up to 4" wide, center sheet over boundary lines.
If sheet covers boundary lines, lift up lower portion for visually checking equal spacing outside of lines.

(C) For paper 4" to 8½" wide, place right edge of sheet on this line.

The three "stop here" arrows in left margin denote that typewriting is within three lines of bottom of sheet.

(D) For paper wider than 8½", locate the middle of the sheet by folding the top edge in half. Open up and place the crease in line with this line.

LOCATING IMAGE ON MASTER

To lessen the need for adjustments by the machine operator, it is good practice to place the image in a uniform location on the master. To determine where to place the image, follow the above directions for the size of paper you intend to use.

Always handle the master along the edges.

EXAMPLE:

Using an 8 x 10½ sheet

1. Place top edge of copy sheet on the top line of the master. **(See A).**
2. Line up right edge of copy sheet on long broken line at right of master. **(See C).**
3. With a non-reproducing pencil, make a slight depression through the copy sheet and into the master at the top left hand margin of the image. Then lift up the corner of the paper and mark this slight depression using the same pencil so the starting point can be readily found later.
4. Insert the master in typewriter. Use an offset ribbon and prepare the image as outlined in this publication.

MAKING CORRECTIONS

Use a soft eraser. A few strokes are usually enough to remove unwanted image from the surface of the master. **Only one erasure should be made in one spot.** The eraser should be kept clean by rubbing on clean paper.

When necessary to reinsert a typed master into the typewriter lay a clean sheet of paper over the master to prevent the typewriter feed rolls from smudging the previously typed image.

(This line also represents the right edge of an 8½" x 13" master.)

57.696

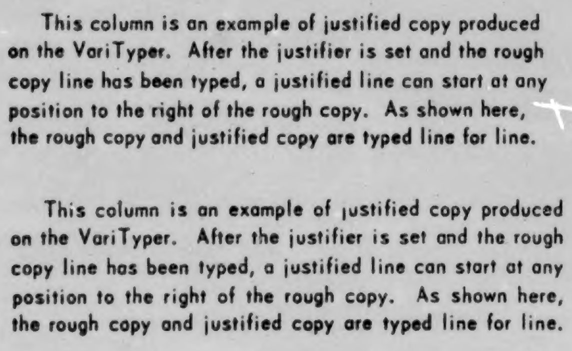
Figure 3-4.—A direct image master.

use of the VariTyper 720. If your shop uses a different model, you will find that the procedures discussed here are similar for all models.

The VariTyper is similar in appearance to an electric typewriter. There are two basic models, the DS (Differential Spacing) and the DSJ (Differential Spacing Justifier). Each model uses interchangeable type fonts and provides proportional (differential) spacing. Proportional spacing automatically spaces each letter to its design width. For example, the "i" and "l" are set in narrower spaces than "W" and "M".

The DSJ model VariTyper machines have the additional capability to automatically justify the copy. In the trade, to justify copy means that the space between words in a line is varied so that each line is the same length. If you look closely at several lines on this page, you can see that the spacing between the words is not equal but each line is the same length.

When you want to justify copy on the VariTyper, it is necessary to type each line twice. During the first typing, the machine registers the amount of space used by the line. The second time the line is typed, the machine automatically inserts the amount of space between the words that is required to space the line to the proper length. You will see how the VariTyper is set up to justify later in this chapter. Figure 3-5 illustrates the two typings required to obtain justification.



This column is an example of justified copy produced on the VariTyper. After the justifier is set and the rough copy line has been typed, a justified line can start at any position to the right of the rough copy. As shown here, the rough copy and justified copy are typed line for line.

This column is an example of justified copy produced on the VariTyper. After the justifier is set and the rough copy line has been typed, a justified line can start at any position to the right of the rough copy. As shown here, the rough copy and justified copy are typed line for line.

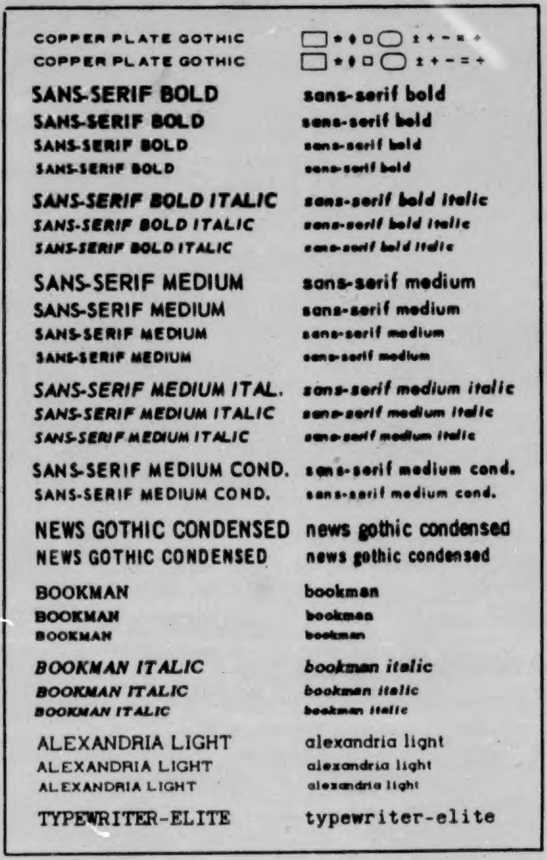
57.696

Figure 3-5.—Justified copy produced on the VariTyper.

Type Fonts

The type plate used in the VariTyper is called a type font. There are hundreds of different sizes and styles of type fonts. The average Navy shop will have four or five styles and two or three sizes of type fonts. See figure 3-6 for examples of VariTyper type fonts which are available.

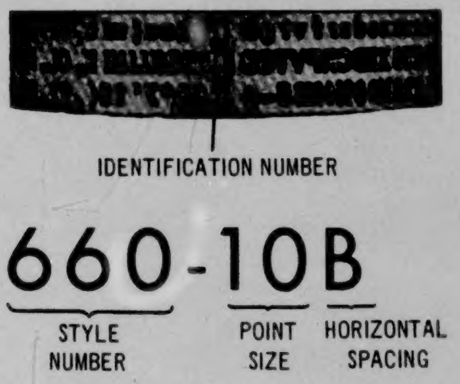
Each font is identified by a series of numbers, which are stamped on the face of the font or scribed on the back of the font. Figure 3-7 illustrates the position of the identification number on the front of a font. The fonts are stored in a drawer at the base of the machine.



COPPER PLATE GOTHIC	□ • ♦ □ ○ ± + − = +
COPPER PLATE GOTHIC	□ • ♦ □ ○ ± + − = +
SANS-SERIF BOLD	sans-serif bold
SANS-SERIF BOLD	sans-serif bold
SANS-SERIF BOLD	sans-serif bold
SANS-SERIF BOLD	sans-serif bold
SANS-SERIF BOLD ITALIC	*sans-serif bold italic*
SANS-SERIF BOLD ITALIC	*sans-serif bold italic*
SANS-SERIF BOLD ITALIC	*sans-serif bold italic*
SANS-SERIF MEDIUM	sans-serif medium
SANS-SERIF MEDIUM	sans-serif medium
SANS-SERIF MEDIUM	sans-serif medium
SANS-SERIF MEDIUM	sans-serif medium
SANS-SERIF MEDIUM ITAL.	*sans-serif medium italic*
SANS-SERIF MEDIUM ITALIC	*sans-serif medium italic*
SANS-SERIF MEDIUM ITALIC	*sans-serif medium italic*
SANS-SERIF MEDIUM COND.	sans-serif medium cond.
SANS-SERIF MEDIUM COND.	sans-serif medium cond.
NEWS GOTHIC CONDENSED	news gothic condensed
NEWS GOTHIC CONDENSED	news gothic condensed
BOOKMAN	bookman
BOOKMAN	bookman
BOOKMAN	bookman
BOOKMAN ITALIC	*bookman italic*
BOOKMAN ITALIC	*bookman italic*
BOOKMAN ITALIC	*bookman italic*
ALEXANDRIA LIGHT	alexandria light
ALEXANDRIA LIGHT	alexandria light
ALEXANDRIA LIGHT	alexandria light
TYPEWRITER-ELITE	typewriter-elite

45.207(57)TX

Figure 3-6.—Some of the type styles available for VariTyper composing machines.



57.14D(57C)AX

Figure 3-7.—Type font identification number.

Machine Set-up Procedures

Before studying the steps of operation of the VariTyper, you should become familiar with the various parts and functions of the machine. Study figure 3-8 carefully and refer to it as you read the following pages.

Inserting the Paper

Most composition on the VariTyper is done on a hard surfaced composition paper. This paper is always placed in the machine with the white side facing the operator. To insert the paper in the machine:

1. Open the feed rolls (I), by moving the feed roll release lever (N), shown in figure 3-8, to the rear.
2. Insert the paper between the feed rolls into the paper basket. Position the paper in the carriage and set the paper guides (L), shown in figure 3-8.
3. Turn the feed roll knob (J), shown in figure 3-8, out to disengage the line spacing device. Turn the knob to roll the paper into the paper basket. Push the knob in and lock it to re-engage the line spacing device.

You should use the split wooden roller to insert long sheets of paper or direct-image masters into the machine. The roller opens and closes by means of a locking clamp at each end. To use the roller, place it in the paper basket in an open position. Insert the paper through the paper feed rolls and into the wooden roller. Next, close the roller and lock the clamps at each end. Now wind the roller so that the working surface of the paper or master is kept inward. Finally, position the roller and paper in the carriage and close the feed rolls.

Inserting the Type Fonts

The anvil (M), shown in figure 3-9, will hold two type fonts. There are two dots on the anvil. Most operators use the side with the black dot for the most frequently used font. The side with the red dot is used for an italic or sub-head font. To insert a type font in the anvil in the printing position:

1. Raise the anvil by moving the type change lever (G), shown in figure 3-8, forward.
2. Place the font in the anvil by aligning the centerline on the font with the dot marking on the anvil. (The small bushing at the rear of the type font is placed downward when you insert the font into the anvil.)
3. Slide the type font to the left until the centerlines of the font and the anvil are aligned.
4. Lift the anvil knob (E), shown in figure 3-9, and turn the anvil so that the type font is facing the paper.
5. Release the type change lever.

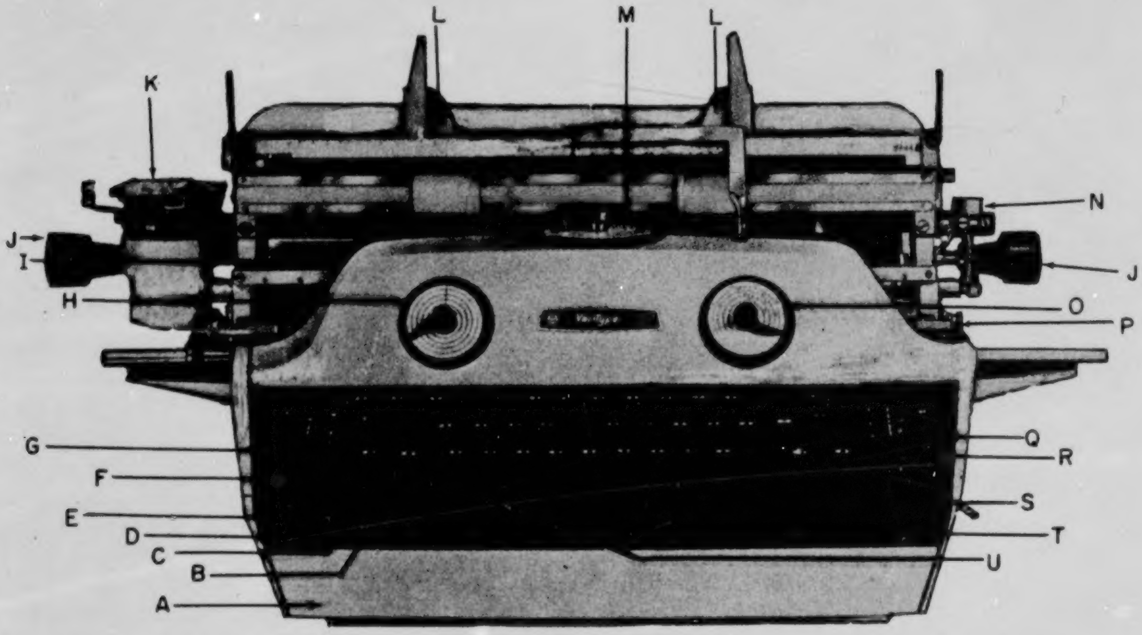
Basic Machine Settings

The following section explains the various adjustments and settings which you must make before you actually begin composing copy with the VariTyper. You must perform each of these operations to produce quality work.

Horizontal Spacing

The term horizontal spacing refers to the amount of spacing allowed for each character of a type font. A 12-point font will naturally allow more characters to a four inch column than a 18-point font.

There are four horizontal spacing selections on the VariTyper; A, B, C, and D. The size and style of the type face being used determines



A. TYPE FONT DRAWER
B. CAPITAL KEY
C. CAPITAL LOCK KEY
D. FIGURE KEY
E. FIGURE LOCK KEY
F. IMPRESSION CONTROL KEY
G. TYPE CHANGE KEY
H. LEFT MARGIN DIAL
I. FEED ROLLS
J. FEED ROLL KNOB
K. LINE SPACING DEVICE
L. PAPER GUIDES

M. ANVIL
N. FEED ROLL RELEASE LEVER
O. JUSTIFIER DIAL
P. MARGIN STOP ADJUSTER KNOB
Q. NON-PRINT LEVER
R. SUPPRESSION CONTROL LEVER
S. AUTOMATIC CARRIAGE RETURN AND PAPER FEED KEY
T. TWO INCREMENT SPACE BAR
U. THREE INCREMENT SPACE BAR

57.14(57C)-720X

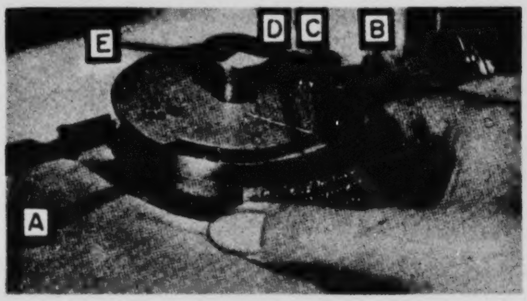
Figure 3-8.—VariTyper line spacing controls.

which horizontal spacing you select. The correct spacing for a font is indicated in the font identification number. (See fig. 3-7.)

As you see in figure 3-10, the horizontal spacing is selected by placing the horizontal spacing lever (A) into one of the slots. The indicator window (B), shows the slot in which you have placed the lever.

Vertical Spacing

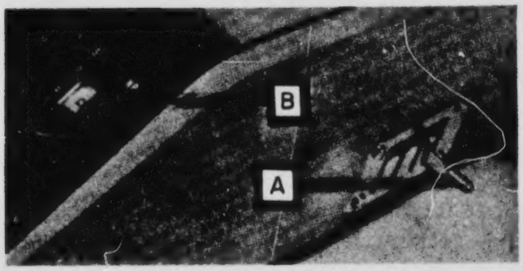
When you make the vertical spacing setting on the VariTyper, you are actually setting the amount of space the paper is moved up after you complete a line. For example, if you are using a 10-point type font and want 2-points of space between each line, you should set the



A. ANVIL
B. CENTERLINE ON TYPE FONT
C. DOT ON ANVIL
D. CENTERLINE ON ANVIL
E. ANVIL KNOB

57.14D(57C)BX

Figure 3-9.—Inserting a type font.

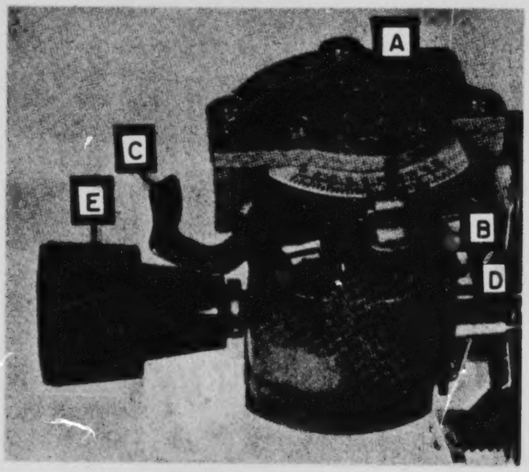


A. HORIZONTAL SPACING LEVER
B. INDICATOR WINDOW

57.697X

Figure 3-10.—Setting the horizontal space setting on the VariTyper.

machine for 12-points of vertical spacing. Then each time you complete a line, the paper will advance 12-points up in the carriage. Refer to figure 3-11 when following these vertical spacing setting procedures:



A. DIAL
B. POINT INDICATOR
C. LINE FEED LEVER
D. LINE FEED DIRECTION LEVER
E. FEED ROLL KNOB

57.698X

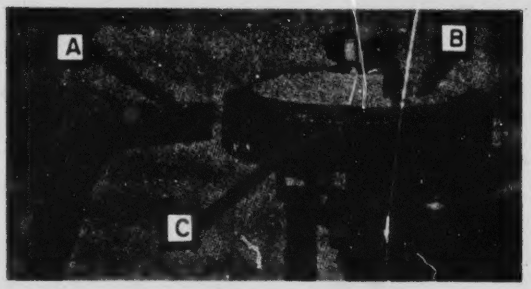
Figure 3-11.—VariTyper line spacing controls.

1. Pull out the point indicator (B) and align its groove with the number on the dial (A) which corresponds to the points of spacing desired. (The dial is marked in half-point graduations from 0 through 18-points.)

2. Position the line feed direction lever to the right to feed the paper upward. Paper feed can be accomplished by using either the line feed lever (C), or the paper feed key (S), shown in figure 3-8. (Note: You cannot feed paper down into the basket with the paper feed key. To lower the paper into the paper basket, move the paper feed direction lever to the left and use the line feed lever.)

Impression Setting

As you can see in figure 3-12, a hammer presses the paper against the type font to produce an image on the paper. The amount of impression applied is controlled by the machine, not by the operator when he depresses the keys.



A. HAMMER
B. ANVIL
C. TYPE FONT

57.14D(57C)CX
Figure 3-12.—Hammer striking a character.

The impression control key (F), shown in figure 3-8, can be set for ten different degrees of impression. The size and style of the type font you are using determines which impression setting you select. The heavier type faces will require a setting in the six to ten range. Medium type faces require a four to five setting. The lower settings are used for the small, light type faces.

Suppression Control

The suppression control lever (R), shown in figure 3-8, lessens the force of the hammer on all the two-increment characters. (An increment is a unit of measurement used in VariTyper composition. The thinnest characters require two increments of space; most lowercase characters, three increments; four increments are required for the majority of the capital (uppercase) characters. See fig. 3-13 for a VariTyper increment chart.)

You can determine whether you need to adjust the suppression control by checking the back side of the composition paper. If the two increment characters appear embossed on the paper, you need to set the suppression control lever to a higher setting. There are eight degrees of suppression control.

ROW	2 Increment	3 Increment	4 Increment
L. C.	l i f t j r , . ; -	a b c d e g h k n o p q s u v x y z	m w
Cap	I , . : !	J S	(All capitals except I-J-S)
Fig	, . ' ' ( )	1 2 3 4 5 6 7 8 9 0 $ ¢ @ # ? * ﬁ ﬂ £ /	% – & ¼ ½ ¾

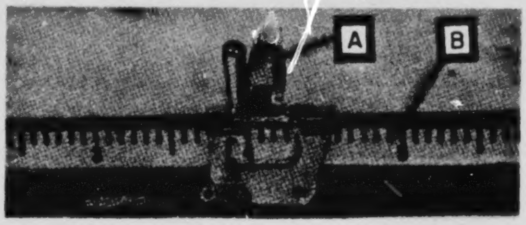
Right portion of Space Bar – 2 increments
Left portion of Space Bar – 3 increments

57.699X
Figure 3-13.—Increment chart of VariTyper characters.

Margin Settings

The VariTyper is equipped with a left margin dial (H), shown in figure 3-8, and a left margin stop, shown in figure 3-14. These devices enable the operator to return the carriage to the same position for each line. To set the left margin:

1. Set the margin stop to the desired position on the scale, as shown in figure 3-14.
2. Press the automatic carriage return key (S), shown in figure 3-8. The carriage will return



A. LEFT MARGIN STOP
B. COPY SCALE

57.700X
Figure 3-14.—Left margin stop.

to the left margin position, which has been determined by the position of the margin stop.

3. Set the left margin dial by aligning the dial pointer with the vertical line on the dial.

4. Check the setting of the carriage position by pressing the carriage return key three or four times and observe the dial pointer. If the carriage has returned to the same position, the dial pointer will be aligned with the vertical line on the margin dial as set in step three above.

When the dial pointer indicates the carriage isn't returning to the exact same position, you can make an adjustment by turning the margin stop adjuster knob (P), shown in figure 3-8. An adjustment of five to eight increments can be obtained with this device.

Typing

The "typing touch" used on the latest models of the VariTyper is similar to that of an electric typewriter. On the older models it is necessary to press all the way down (bottom) each key.

The lowercase letters are located in a row at the top of the type font; the capital letters are located in the center row; and the figures are located in the bottom row. To type a capital letter, depress the capital key (B) and hold it as you type the letter. (See fig. 3-8.) To strike a figure, hold the figure key (D) down as you strike the key. To lock the font in position when you are typing more than one successive capital letter or figure, press the capital lock key (C), or figure lock key (E), down. This will lock the font in position until you release it by pressing down on it.

You have already seen how to set the left margin dial (H), shown in figure 3-8. You can mark this dial with a pencil for other starting points, such as paragraph indentions, tabular columns, and so on.

Line Centering

Before you put the paper into the machine, you should mark it with blue pencil to indicate the center and the right and left margin of your column. You can then center a line by moving the carriage until the point or peak at the top of the ribbon shield is alined with the mark indicating the left edge of your column.

Next, push up on the nonprint lever (Q), shown in figure 3-8, and type the line "blind." Continue typing, using "m's" and the increment space key until the point on the ribbon shield alines with the mark on the right side of the column. Keep track of the number of "m's" and increment spaces required to fill out the line.

Return the carriage until the point on the shield is again alined with the mark indicating the left margin. Blind type half the number of "m's" and increments it took to fill out the line. Space over two more increments. (This is necessary because the machine starts typing two increments to the left of the position indicated by the point at the top of the ribbon shield.) Lower the nonprint key and type the line. It should be exactly centered.

Justification

As you have seen, the DSJ models are built to justify the right margin of the copy by automatically inserting space between the words. To justify the right margin, the operator must type the copy twice. He types the rough line on the left side of the paper and then tabulates and types the finished line on the right side.

As he types the rough, a bell rings to warn him when a line is almost full. If he has room on the line to type the next word (or syllable) in the copy he can; if not, he carried the word over to the next line. The dial mechanism on the machine records the amount of spacing that is required to finish out the line and this spacing is automatically inserted between the words when he tabulates and types the finished line.

After the job is finished, he trims the smooth copy and uses it for reproduction purposes; the rough copy is thrown away, or if classified, destroyed as classified waste.

Since present Navy policy is generally against the use of justified lines if two typings are required, detailed instructions for justification are not included in this manual. You may study the manufacturer's instruction book in case you would like to know how it is accomplished.

Changing the Ribbon

Figure 3-15 shows how to thread the ribbon through the machine. When changing the ribbon, first remove the take-up spool (I) shown in the illustration. Hold the right side of the spool and turn the other side away from you until it stops. Pull the spool to the left to remove it. Discard the used ribbon and reverse this process to replace the empty spool.

Next, lift the strap (G) and remove the empty spool on the right side of the machine. Place a new ribbon on spindle (F). The illustration shows the direction the ribbon should feed from the spool. Thread the ribbon through guides (C), keeping the carbon side of the ribbon facing the back of the machine at all times.

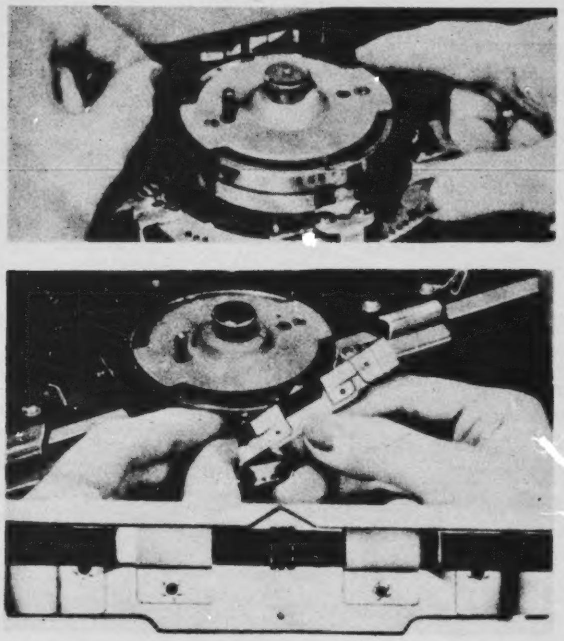
Just back of the anvil, you will find a ribbon shield. (See fig. 3-15.) You can remove this shield by pressing prong (E) to the left and lifting the holder from both the right and left prongs. Hold the shield with the ribbon guides facing you and thread the ribbon through right to left in the manner shown in figure 3-16. Replace the shield by slipping the loops back over the right and left prongs on the holder.

Thread the ribbon through guides (B). Then open the feeder wheels (A) and thread the ribbon between them. Finally thread it through guide (H) and slide it into the slot on the left side of the take up spool, carbon side toward you. Allow about 1" of the ribbon to hang out on the left. Hold the feeder wheels (A) open and

A. FEEDER WHEELS
B. GUIDES
C. GUIDES
D. LEFT PRONG OF SHIELD HOLDER
E. RIGHT PRONG OF SHIELD HOLDER
F. SPINDLE
G. STRAP
H. GUIDE
I. TAKE-UP SPOOL

57.701X

Figure 3-15.—Replacing a VariTyper ribbon.



57.579X

Figure 3-16.–VariTyper ribbon shield.

turn the take-up spool 3 or 4 times to wind a few inches of ribbon on the spool.

Note.–When you are typing classified materials on the machine, the used ribbon will contain a readable image and should be handled as classified waste.

IBM PROPORTIONAL SPACING MACHINE

Besides the typewriter, you may have occasion to use the IBM Proportional Spacing Machine shown in figure 3-17. It is operated much the same as the ordinary electric typewriter, but it has certain features that gives it an edge over the regular typewriter in the preparation of photo-offset copy.

For one thing, the letters on this machine are designed to look like conventional type faces. As you can see in figure 3-18, IBM type styles include romans, gothics, and italics. These faces are not interchangeable. Each is built on a separate machine. To change faces the operator must switch to another machine.

Copy produced on these machines looks very much like typeset composition because of an ingenious proportional spacing system. While the ordinary typewriter allows the same amount of space for each letter–a thin letter like "i" occupying the same amount of space as the wide letter "W"–these machines allow each letter only the exact amount of space it requires.

The spacing is divided into units measuring 1/32 of an inch each on some machines, and 1/36 or 1/45 of an inch each on others, depending on the width of the letters and the type style carried. (See fig. 3-19.)

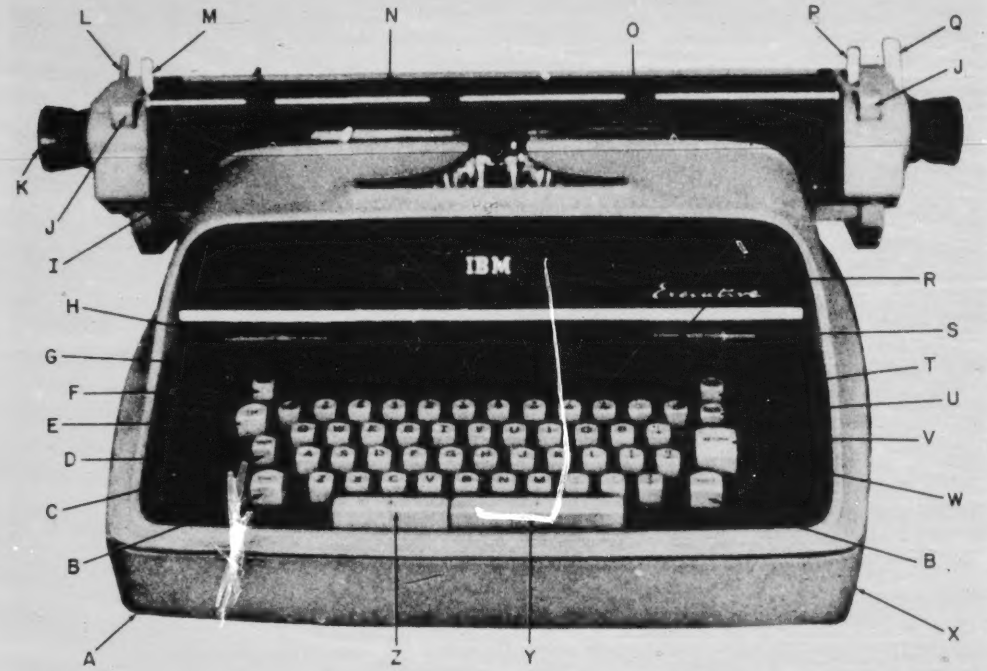
As you can see in the illustration, the widest letter M and W, each occupy 5 of these units, while the smaller letters, such as f, l, i, and t, require only two. Capital and lowercase letters do not always take the same amount of space.

The operating instructions are similar for all machines regardless of the type face they carry. Figure 3-17 shows most of the operating parts. The switch (X) is for turning the power off or on. The keyboard locks when the power is off. On the left side of the machine, you will find the impression indicator (D). Moving the lever (A) toward 10 on the indicator increases the pressure, and moving the lever toward zero reduces it. The impression is set correctly when commas and periods print sharply but do not punch. The multiple copy control lever (P) is used to adjust the machine for various thicknesses of paper when carbon copies are required. You should leave the lever set at "A" unless you are typing more than four sheets, in which case you can move it forward one notch for each additional three sheets.

Under the left side of the keyboard, just to the left of the impression control lever, you will find a notched wheel which you can move forward or backward to adjust the machine for your particular typing touch.

Keyboard

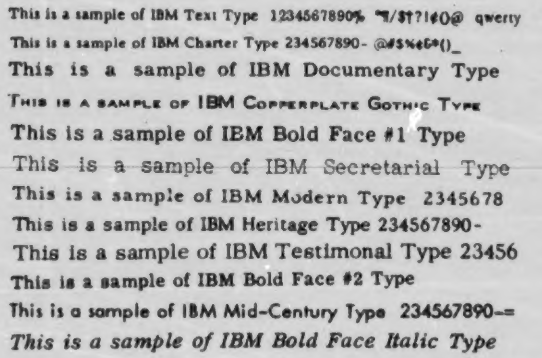
Except for spacing bars and a few special control buttons, the Proportional Spacing Machine has a standard typewriter keyboard and



A. Lever for adjusting impression (hidden).
B. Shift key.
C. Shift key lock.
D. Impression indicator. Move lever (A) to move indicator toward 10 to increase pressure.
E. Tab key.
F. Margin release. Enables you to type outside left margin.
G. Ribbon position button. Push down when typing stencils.
H. Word expander button. Push up to insert extra space between letters in words.
I. Front paper scale.
J. Carriage release lever.
K. Variable line space knob. Press in to release roller when reinserting or positioning paper.
L. Line position reset lever. Permits typing between lines and return to original typing position.
M. Line space lever. Can be set for single, double, or triple spacing.
N. Copy guide.
O. Clear view card holder.
P. Multiple copy control lever used in typing carbons. Keep set at "A" for less than four sheets. Move forward one notch for each additional three sheets.
Q. Paper release lever. Frees paper for straightening or removal.
R. Tab clear button.
S. Tab set button. To set, move carriage until typing indicator is alined with one of the numbers on the front paper scale (I).
T. Margin reset button.
U. Back space button.
V. Carriage return button.
W. Switch indicator. Turn switch off and on with lever (X).
X. Switch for turning machine off and on (hidden). Keyboard locks when power is off.
Y. Two-unit space bar.
Z. Three-unit space bar.

57.30X

Figure 3-17.—IBM Proportional Spacing Machine. Action will repeat itself as long as the dash, backspacer, carriage return, or three-unit space bar is held down.



This is a sample of IBM Text Type 1234567890% ¶/$†?!¢0@ qwerty

This is a sample of IBM Charter Type 234567890- @#$%¢&*()_

This is a sample of IBM Documentary Type

THIS IS A SAMPLE OF IBM COPPERPLATE GOTHIC TYPE

This is a sample of IBM Bold Face #1 Type

This is a sample of IBM Secretarial Type

This is a sample of IBM Modern Type 2345678

This is a sample of IBM Heritage Type 234567890-

This is a sample of IBM Testimonal Type 23456

This is a sample of IBM Bold Face #2 Type

This is a sample of IBM Mid-Century Type 234567890-=

This is a sample of IBM Bold Face Italic Type

45.207(57)SX

Figure 3-18.–Some of the type styles available for the IBM Proportional Spacing Machines. (Reduced.)

it is operated much the same as the ordinary electric typewriter.

Marginal stops and tabulating stops are positioned for every four units, and you can set them with special keys (buttons) on the keyboard. The return button (V), shown in figure 3-17 is for returning the carriage by power. Each time the carriage is returned, the paper is advanced in the machine to receive the next line. You can set the machine for single, double, or triple spacing by adjusting the line space lever (M) shown in figure 3-17.

You can move the carriage by hand by pressing the carriage release lever (J) on either side of the machine, but you should use the return button for returning the carriage when you are typing.

Bold Face No. 1, Documentary, Modern, Secretarial (1/32" unit type), and Bold Face No. 2 (1/36" unit type):

1. All lower case alphabetical characters and numbers, period and comma, 3 units, except:
   flitj—2 units
   w—4 units
   m—5 units
2. All upper case alphabetical characters are 4 units except:
   SWIMJ
   3 5 2 5 3

Charter (1/45" unit type):

1. All lower case alphabetical characters and numbers, period and comma, are 3 units except:
   flitsjrz—2 units
   w—4 units
   m—5 units
2. All upper case alphabetical characters are 4 units except:
   IJ—2 units
   BEFLPSZ—3 units
   MW—5 units

Text (1/45" unit type):

1. All lower case alphabetical characters, and numbers, period and comma, are 3 units except:
   flitsjr—2 units
   w—4 units
   m—5 units
2. All upper case alphabetical characters are 4 units except:
   IJ—2 units
   BEFLPRS—3 units
   MW—5 units

Mid-Century (1/36" unit type):

1. All lower case alphabetical characters, and numbers, period and comma, are 3 units except:
   flitsjr—2 units
   wm—4 units
2. Upper case alphabetical characters are 4 units except:
   I—2 units
   BESTFJLPR—3 units
   NOWGMQ—5 units

Copperplate Gothic (1/45" unit type):

1. All lower case alphabetical characters are 3 units except:
   ij—2 units
   mw—4 units
2. All upper case alphabetical characters are 1 unit larger than lower case except for "I" which is 2 units in both cases.
3. Numbers, period, and comma are 2 units in lower case; 3 units in upper.

Heritage (1/36" unit type):

1. All lower case alphabetical characters, and numbers, period, and comma, are 3 units except:
   flitjr—2 units
   w—4 units
   m—5 units
2. All upper case alphabetical characters are 4 units except:
   SWIMJB
   3 5 2 5 2 3

57.31AX

Figure 3-19.–Unit charts of type faces used on the IBM Proportional Spacing Machines.

Setting the Margins

To set the left margin, you should press the return button to move the carriage to the right of the machine. Then hold the margin reset button (T) while you move the carriage manually to the point where you wish to start your left margin. The margin will be set automatically when you release button (T).

To set the bell for the right margin, you should first return the carriage; then move it to the left manually. The moment the bell rings, depress the margin reset button (T) and hold it while you continue to move the carriage to the point where you wish to locate your right margin. When you release the margin set key, the bell will be reset to ring when your typed line approaches within 20 units of this margin.

The margin release button (F) will enable you to type outside your left margin when it is necessary.

Spacing

As an aid in justifying lines, this machine is equipped with two space bars. One moves the carriage two units; the other moves it three. When you want one-unit spacing, you must use the two-unit space bar and then backspace one unit. Two-unit spacing is generally allowed between words, but this may be varied as necessary. Figure 3-20 shows the effects of different spacing between the words in a sentence.

This is to show various spacing between words.	(1 unit
This is to show various spacing between words.	(2 units)
This is to show various spacing between words.	(3 units)

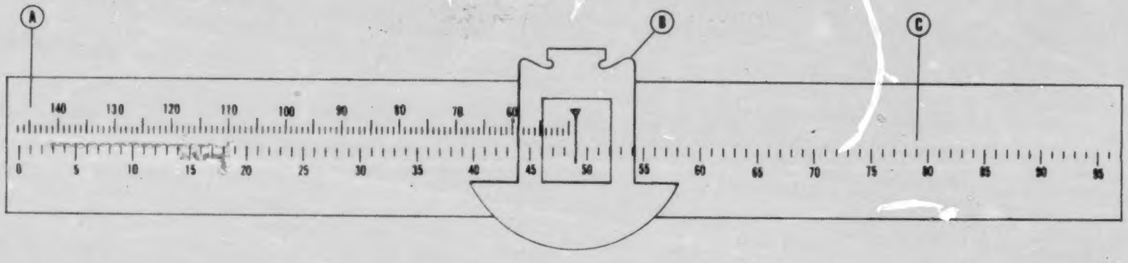
57.31X

Figure 3-20.—Comparison of different unit spacings between words.

The word expander button (H), shown in figure 3-17, is used to automatically insert an extra unit of space between the letters in the words. It is very useful for letterspacing headings. When this button is pushed up, the two-unit space bar spaces three units and the three-unit space bar spaces four.

Centering

You can center a heading by typing it first on a sheet of waste paper. Position the carriage at the center point on the front scale (C) shown in figure 3-21. Type the heading and note the position of the carriage on scale (C). Next insert the paper you are going to use. (To center the paper, position the carriage at the center point on scale (C) and insert the paper so that the edges are equi-distant from the two vertical marks on the clear view card holders (O) shown in figure 3-17). Then move your carriage until the indicator (B) shown in figure 3-20 is at the



A. Centering scale.
B. Indicator.
C. Front paper scale.

57.33.1

Figure 3-21.—The front paper scale.

point on the centering scale (A) that corresponds to the reading you got on scale (C) when you typed the rough line, and type your heading.

You can also count the number of units in the heading (including spaces between words) and subtract this from the total number of units in the line. Divide this amount by two. Space over the required number of units and type your heading. The chart in figure 3-19 shows the number of units for each letter and you can use it as a guide in counting the number of units in the heading. Since this chart also shows the number of units per inch for various styles of type, you can use it in determining the total number of units in the line you are typing.

Relocating Your Typing Position

You can also use the chart in figure 3-19 to find the number of units you must backspace if it is necessary to type over a character.

To find your typing position after you have erased a character, you should move the lever (A) shown in figure 3-22 to the left to bring the wire pointer (B) up over the line, as shown in the illustration. Line up the right edge of the preceding character with this pointer. Then release lever (A) and type the correct character. If the letter to be corrected is the first letter in a word, aline the wire pointer with the right edge of the last letter in the preceding word. Then space with the two-unit space bar (in case you have been using two-unit spacing) and type the correct character.

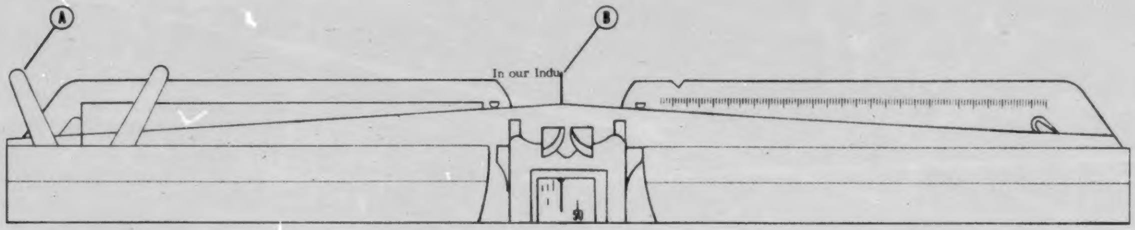
You may use the small knob variable line spacer (K) on the end of the platen roller to help locate your position on the line when you are reinserting a typed page into the machine. (See figure 3-17.) When you press the knob, the platen roller is released, and you can turn the paper to any position without regard to the regular spacing. You may also use this knob to move your work to the proper position when you are filling in ruled forms.

The line position reset lever (L) shown in figure 3-17, also releases the platen roller and may be used for similar purposes. However, when you release this lever, the machine automatically returns to its regular line spacing.

Justification

The Proportional Spacing Machine is not equipped with an automatic justifying mechanism. In order to justify the lines it is necessary to type the copy twice. The operator codes the lines as he types the rough copy using the justification scale, shown in figure 3-23, to tell how many units each line runs short of or over the required length. He types this number (code) at the end of each line and uses it as a guide in adjusting the space between the words when he types the smooth copy.

Of course, as you have already read, present Navy policy is against the use of justification when two typings are involved.

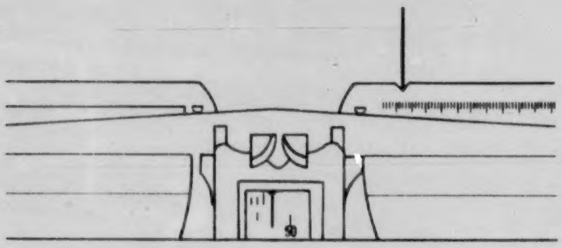


A. Lever.

B. Reposition indicator.

57.33.2

Figure 3-22.—Wire pointer (B) raises when lever (A) is pushed to the left. Line up the right edge of the preceding character, as shown here, to find your position when typing over an error. Lower pointer before typing new character.



57.33.3

Figure 3-23.—The justification scale is graduated in units. To justify copy, place a pencil in the notch on the scale and turn the platen roller to draw a vertical line down the sheet at this point. When you come to the end of each line as you type the rough copy, look at the notch to see how many units it runs short or over the pencil line. Then tabulate and type the number of units the line is short or over, using a plus or minus sign to indicate if space must be added or deleted from between words during the second (smooth) typing. If a line ends with a period or comma, backspace once before reading the scale.

Changing the Ribbon

The ribbon supply indicator is visible through the on-off switch window (W) shown in figure 3-17. When red shows in the window, you are ready for a new spool.

To change the ribbon, lift the cover of the machine by releasing the right and left latches under the keyboard immediately in front of the impression indicator and the on/off switch. (See fig. 3-24.) Push the ribbon release button (H) shown in the illustration to free the take up spool on the left side of the machine. Remove the spool and discard the used ribbon. Replace the spool and turn it until the mounting bracket snaps in place. (Note.—if you have been typing classified material on the machine, the used ribbon will contain a readable image and should be handled as classified waste at the end of each day.)

Place a new spool of ribbon in position on the right side of the machine. The ribbon should feed from the back of the spool and in front of the tension wire (A). Thread the ribbon through the right spool guide, the right corner guide, center guide, left corner guide, pressure guide, through the rollers, and on to the take-up spool. Follow the line and arrow on the take-up spool. The rollers will automatically re-engage when you type your first stroke.

Maintenance

You should clean the type on your machine daily with a bristle brush and a dry cloth. If it is necessary to use solvents, go over the keys with a cloth moistened with a mild detergent. Some cleaning solvents will damage the plastic parts and paint on the machine.

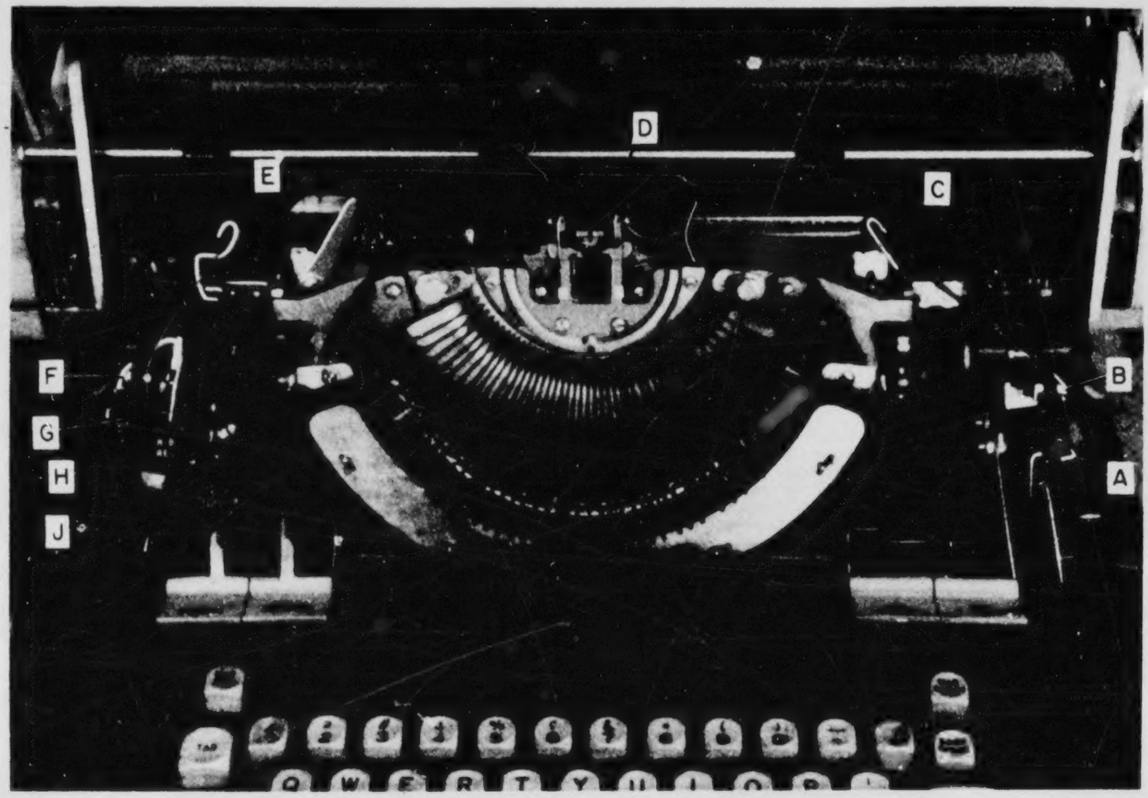
At regular intervals, you should remove the platen and the metal deflector underneath and clean the feed rollers and platen with platen cleaner or type cleaner (Federal Stock No. 7510-527-1458). If you do not have type cleaner in your shop, you can get it from the Yeomen in the ship's office. Do not use blanket wash on the machine and do not attempt to oil the machine, as oil might contact the rubber parts and cause damage.

MODEL D

Figure 3-25 shows the operating controls D of the IBM Proportional Spacing Machine. You will notice that several changes have been made on the keyboard.

This machine has 7 typamatic keys: the carriage return, the backspace key, the hyphen and underscore, the period, the letter "x", and the two-unit and three-unit space bars. A single action occurs when these keys are depressed to the first level, but when depressed to the second level and held, the action repeats itself until the key is released. For example, you can type a row of leaders (dots) by simply holding the period down until you reach the desired line length.

The page-end indicator (Q), shown in the illustration shows how many inches are left at the bottom of the page when you are typing. The no-print lever (R) is for typing blind to determine the length of a line before it is actually typed. It is very useful in centering heads. The repositioning indicator lever (F) serves the same purpose as the lever (A) shown in figure 3-22. When this lever is depressed, a



A.	Tension wire.	F.	Pressure guide.
B.	Guide.	G.	Pressure rollers.
C.	Guide.	H.	Ribbon release button.
D.	Guide.	J.	Take-up spool.
E.	Guide.		

57.572

Figure 3-24.—Carbon ribbon threads from spool on right to take-up spool on left. Latches on the right and left sides under the keyboard release the cover.

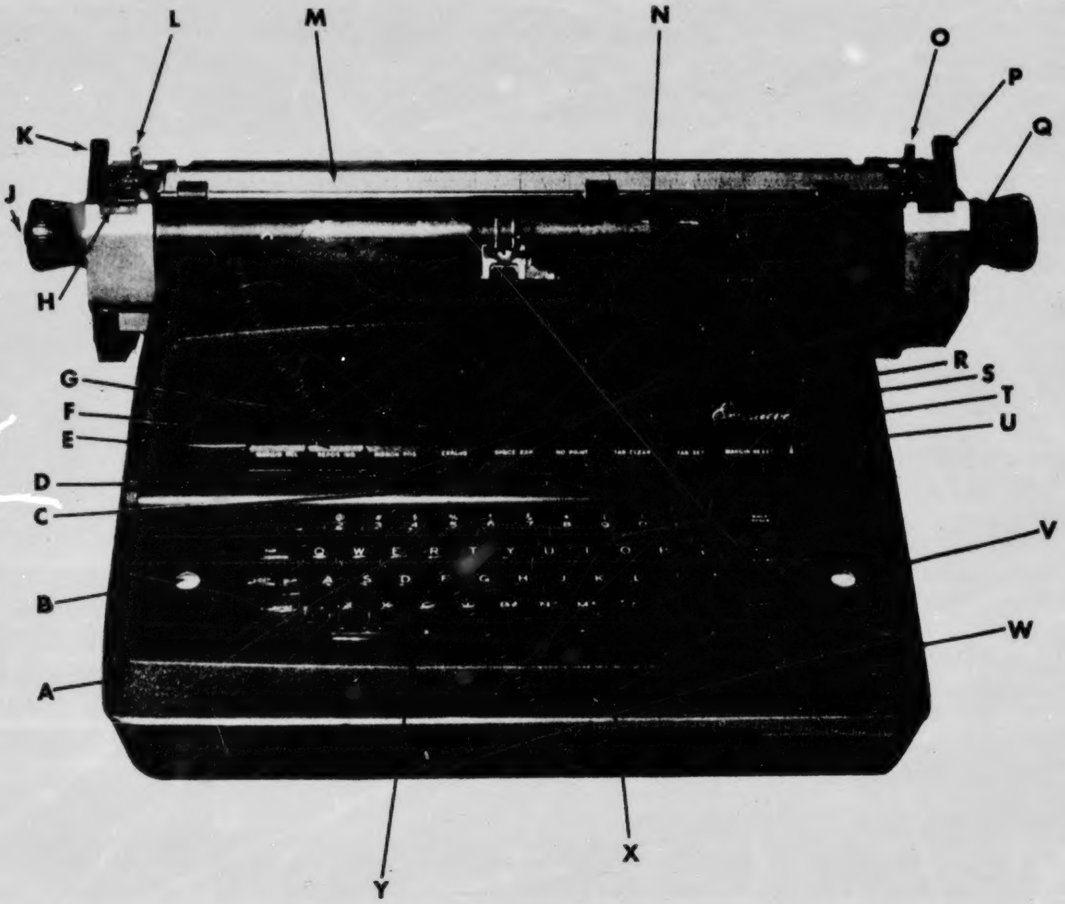
wire indicator raises to help you find the proper position for the carriage when you are typing over an erasure.

The expander lever (D) is for adding space between the letters in a word. When it is down, the two-unit space bar moves the carriage three units, and the three-unit space bar moves the carriage four units.

The space expand lever (C) causes the two-unit space bar to space three units, but does not affect other parts of the machine. When levers (C) and (D) are both depressed, both space bars move the carriage four units at a time.

IBM SELECTRIC TYPEWRITER

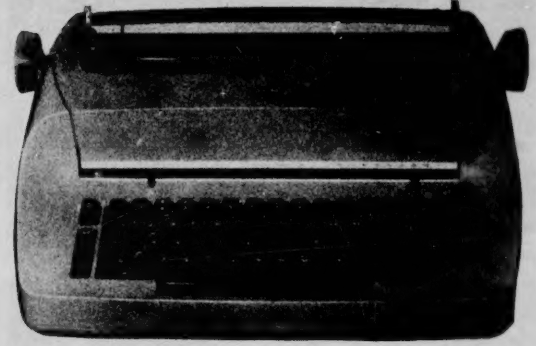
Figure 3-26 shows an IBM Selectric Typewriter. The machine differs from the conventional electric typewriter in that the carriage does not move and there are no typewriter bars. Instead, when the operator depresses a key, a



A. Impression control lever (hidden).
B. Impression indicator.
C. Space expand lever. Causes the two-unit space bar to move the carriage three units.
D. Expand lever. For adding space between letters in words and adding an extra unit of space each time the space bars are depressed.
E. Margin release lever.
F. Repositioning indicator lever. Raises wire pointer to line up position of carriage when typing over an erasure.
G. Ribbon position lever.
H, Carriage release lever.
J. Platen variable.
K. Line position reset lever.
L. Line space lever.
M. Copy guide.
N. Clear view card holder.
O. Multiple copy control.
P. Paper release lever.
Q. Page-end indicator. Shows how much space is left at bottom of page.
R. No print lever used in typing blind, as when centering heads.
S. Tab clear lever.
T. Tab set lever.
U. Margin reset lever.
V. On-off indicator.
W. On-off switch (hidden).
X. Two-unit space bar.
Y. Three-unit space bar.

57.573X

Figure 3 25.—The IBM Executive Typewriter, Model D.



57.574X

Figure 3-26.–IBM Selectric Typewriter.

small ball (type font) skims across the page to bring the proper character into printing position. If two keys are struck rapidly, one after the other, the machine "holds" the second character until the first is printed out. This eliminates crowded or missing characters and makes for a smooth, fast typing rhythm.

Typefaces can be changed on these machines. You can remove the ball (font) for one type face and replace it with another in a matter of seconds. The type fonts are relatively inexpensive and there is a variety of type faces available. However, these machines do not have proportional spacing; they use standard typewriter spacing, allowing the same amount of space for each letter. Both carbon ribbon and fabric ribbon models of these machines are available. The carbon ribbon models are generally used for typing for reproduction.

IBM Magnetic Tape Selectric Typewriter

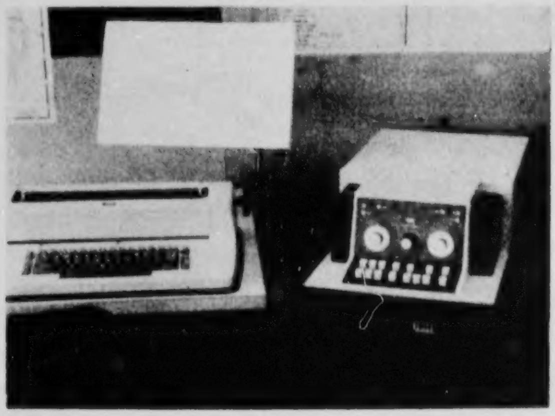
Figure 3-27 shows another IBM typewriter, known as the Magnetic Tape Selectric Typewriter (MTST). This machine is similar to the Selectric Typewriter just described in that the carriage does not move and the type fonts are interchangeable. However these machines have many features not found on the regular Selectric Typewriter. For example, the operator can produce a magnetic tape at the time he types the rough copy. This tape can then be run through the machine again to retype the material automatically.

If the operator makes a mistake in typing, he can simply backspace and retype the character. The operator can also correct his tape after all the copy has been typed, by running it through the machine a second time and typing corrections in manually wherever they occur. If he desires, he can make a second "corrected" tape as he types in manual corrections. He can also type in large alterations on a second tape and combine the information from both tapes as he feeds them through the machine.

When the tape is put through the machine a second time, all typing is automatic unless the operator desires to type in corrections by hand. If changes are made in copy or the margins are reset, the machine respaces sentences, adjusts line lengths, and even drops hyphens at the ends of lines automatically. Each tape cartridge holds 100 feet of reusable magnetic tape and each cartridge has a storage capacity of approximately 24,000 characters.

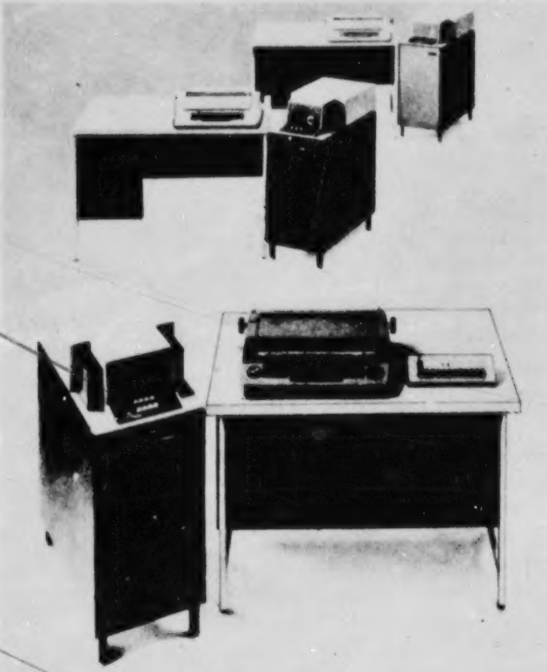
Like the Selectric Typewriter, this machine produces unjustified copy and uses standard typewriter rather than proportional spacing.

Figure 3-28 shows an IBM Magnetic Tape Selectric Composer. This machine uses proportional spacing and type faces that closely



57.575X

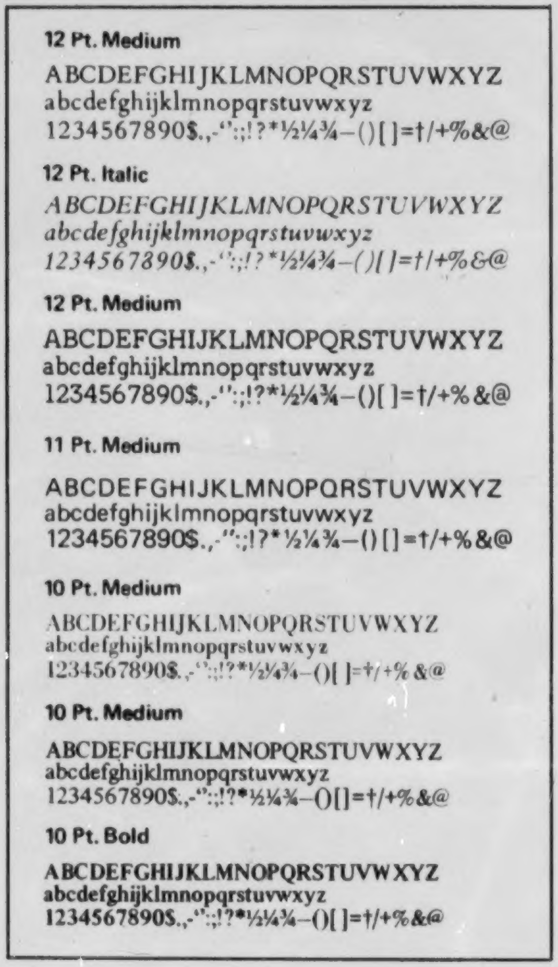
Figure 3-27.–Magnetic Tape Selectric Typewriter (MTST).



57.576X
Figure 3-28.—IBM Magnetic Tape Selectric Composer and Recorder.

resemble printer's type. (See fig. 3-29.) The typist can type on it manually to produce unjustified copy or he can use it with tapes produced on the Recorder, shown in figure 3-28. When used with tapes, the composer will retype the material automatically and produce justified copy if desired. It is equipped to accept the main tape plus a correction tape and insert the corrections in the proper places in the finished copy. Production of tabular matter and centered copy is practically automatic and simple or complex format changes can be made without rekeyboarding.

Type faces for this machine are available in a variety of styles and point sizes which are quickly interchangeable. (See fig. 3-29.) It can be adjusted for leading and spacing for the various type sizes.



12 Pt. Medium

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$.,-'':;!?*½¼¾–()[ ]=†/+%&@

12 Pt. Italic

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
*1234567890$.,-'':;!?*½¼¾–()[ ]=†/+%&@*

12 Pt. Medium

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$.,-'':;!?*½¼¾–()[ ]=†/+%&@

11 Pt. Medium

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$.,-'':;!?*½¼¾–()[ ]=†/+%&@

10 Pt. Medium

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$.,-'':;!?*½¼¾–()[ ]=†/+%&@

10 Pt. Medium

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$.,-'':;!?*½¼¾–()[ ]=†/+%&@

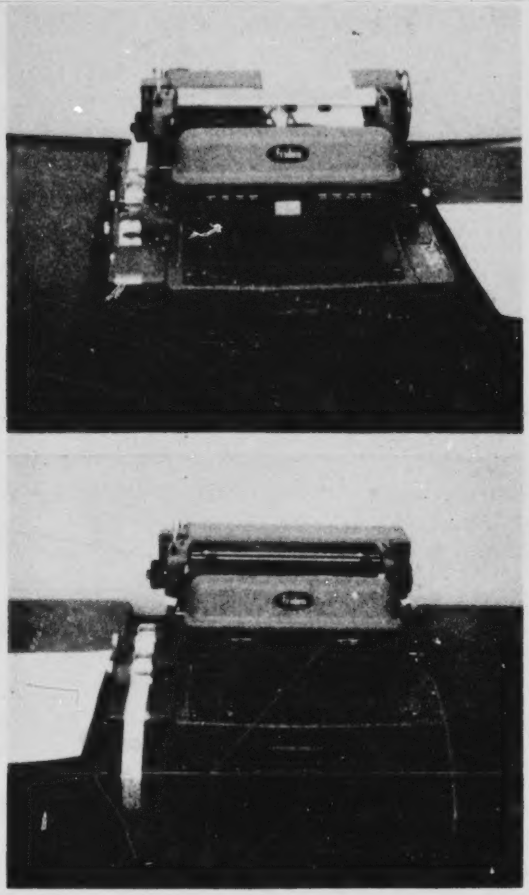
10 Pt. Bold

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$.,-'':;!?*½¼¾–()[ ]=†/+%&@

57.577X
Figure 3-29.—Some of the type faces available for the Selectric Composer.

The Justowriter

The Justowriter, shown in figure 3-30, actually consists of two machines: a recorder and a reproducer. The recorder is built for proportional spacing and is operated much the same as the IBM Proportional Spacing Machine. However, as you type, in addition to typing rough copy, the machine also punches a tape. As you reach the end of a line, a light goes on and you



57.37X

Figure 3-30.—Justowriter Recorder, above, and Reproducer, below. Recorder types rough copy and punches tape. Tape is fed into Reproducer to provide final smooth copy.

can punch the justifying key at any time thereafter. The justifying key automatically punches a spacing code for the line and returns the carriage.

After the rough copy is typed, the tape is removed from the recorder and placed in the reproducer in such a manner that the code for each line enters the machine first. As the tape travels through the Reproducer, the copy is automatically typed and spacing is adjusted between words to make all lines come out to the same length.

If you make a mistake when you are typing the rough copy, you simply press the "line delete" key and retype the line. The line with the error is then thrown out automatically when the reproduction copy is typed.

If illustrations are to be used with the typed matter, you should mark the size and place where they are to be inserted on the rough copy before you run the tape through the Reproducer. You should then watch the rough copy and the material being composed on the Reproducer as the tape is run through. When you reach the point where an illustration is to appear, you should stop the machine and turn it manually to leave the correct amount of space for the illustration.

Type faces are available in a variety of styles and sizes ranging from 8 to 14 point. (See fig. 3-31.) Although each machine carries only one type face, the style and size of type used on the Reproducer does not necessarily have to match that used on the Recorder. The tape will reproduce on the second machine regardless of type style and size used in preparing it. Sometimes the Reproducer is equipped with a 12-point bold face roman type and the Recorder is equipped with 12-point italic. In this case, you can set italicized words by leaving black spaces on the smooth copy and then typing them in manually on the Recorder or by typing them separately on the Recorder and pasting them into place on the smooth copy.

DISPLAY COMPOSITION

Type larger than 14 point is classified as display type. Display composition may consist of hand lettering, paste-down letters, or material produced on photo-composing equipment.

Hand Lettering

Hand lettering gives work a friendly, informal tone. And because it can be made to fit into almost any space or design, it is important in the preparation of photo-offset copy.

10 Point Booktype
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

10 Point Modern
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

12 Point Galvin
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefhgijklmnopqrstuvwxyz

12 Point Bold Face
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

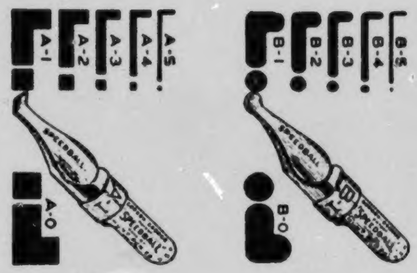
12 Point Bold Face Italic
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

12 Point Documentary
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

14 Point Commercial
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

57.38X
Figure 3-31.—Justowriter type faces.

Hand lettering for reproduction should be done with india ink or with black water colors. It is usually done with a brush or pen. Precision lettering, of course, requires ruling the outlines of the letters with a ruling pen and filling them in with a brush. Fine pen points, such as Gillot's 303 or crow quill pens may be used for squaring up corners; and chinese white may be used to touch out raggedness. Special lettering pens, such as the Speedball pens shown in figure 3-32, are sometimes used for freehand work.



45.123:.124
Figure 3-32.—Speedball pen points.

Mechanical Lettering

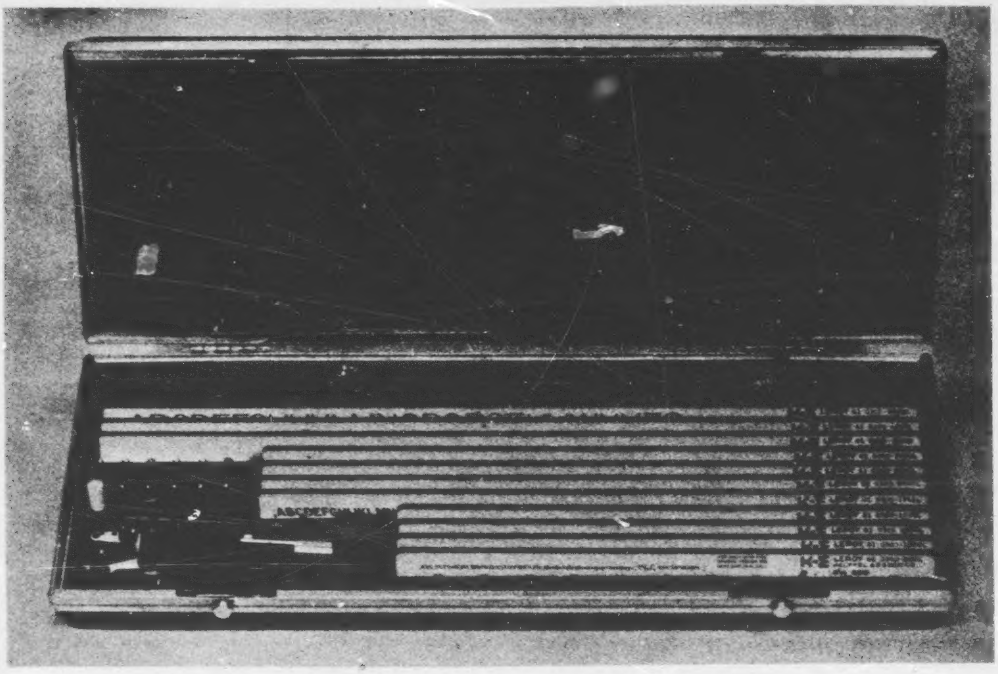
If you aren't an artist, there is a chance that your freehand lettering may look pretty sad. Lettering is an art and it takes a great deal of practice to become proficient at it. But if you are not a lettering man, don't despair; there are a number of mechanical devices that you can use.

The Leroy, for example, is a mechanical lettering instrument which can be used by one who has had no previous lettering experience. A pen which is gaged to produce letters of even thickness is inserted into a device known as a scriber, which is moved along a template or lettering guide. Leroy pens are supplied in a variety of sizes for different thicknesses of line, and templates are available for several sizes of letters. (See fig. 3-33.)

You can produce italics with the Leroy set by adjusting the arm of the scriber, and you can change pen points by releasing the setscrew shown in figure 3-34. You should always wash the pens in water or in cleaning fluid immediately after you use them. Dried ink clogs the pens and causes ragged lines.

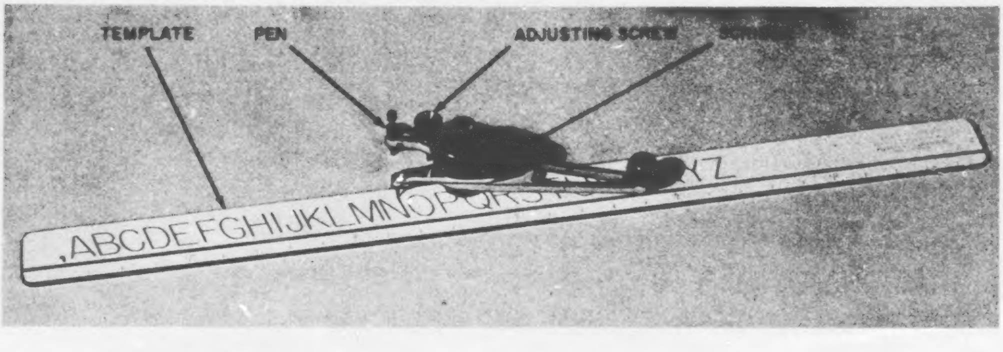
Leroy letters always have rounded corners, but you can square them with a fine-pointed pen. Letters squared in this manner look much the same as single-stroke brush lettering.

When you are doing any kind of lettering, it is always safer to pencil in guide lines to ensure the alinement of the letters. Some operators go even further and roughly pencil all letters in their proper position before they do the finished work. This procedure is especially useful when you are lettering columns of figures or doing other types of tabular work.



142.349X

Figure 3-33.—A Leroy lettering set.


TEMPLATE
PEN
ADJUSTING SCREW
SCRIBER

45.120X

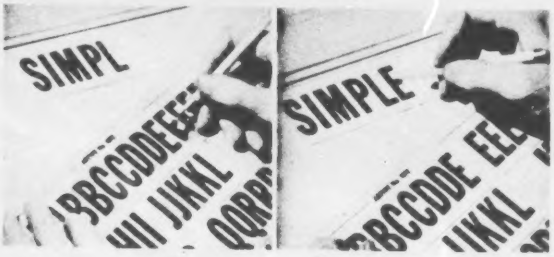
Figure 3-34.—Leroy pen and template.

Pastedown Lettering

Although good hand lettering is very effective, it is slow and tedious. Therefore, most operators resort to other methods for producing needed display lines. Special alphabets of letters printed on sheets of transparent acetate are widely used in composing headings and titles for coldtype composition.

Art Type and Visi-Type

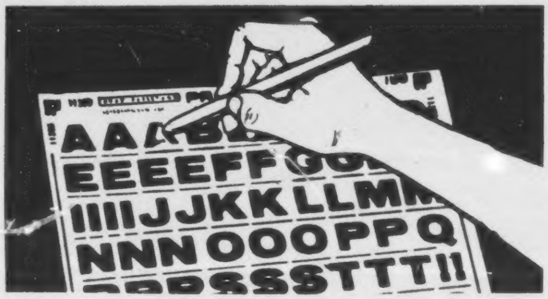
There are a number of alphabets which are printed on sheets of transparent acetate or cellophane. These sheets are waxed on one side for pastedown purposes, and you can simply cut the letters out with a knife and apply them directly to the master copy. These alphabets are known by such trade names as Para Type, Art Type, and Visi-Type. One advantage of these letters is that they can be applied directly to artwork without covering or blocking it off with white space. Another advantage is that they do not leave a shadow outline on the negative when the work is photographed, provided they have been thoroughly burnished down. (See fig. 3-35.)



57.15X
Figure 3-35.—Paste-down lettering may be used for display faces.

Pressure-Transfer Lettering

Pressure-transfer lettering is similar to Art Type and Visi-Type in that the letters of the alphabet are printed on acetate sheets. But, as you can see in figure 3-36, instead of cutting the letter out of the acetate sheet and attaching it to the artwork, when you are using pressure-transfer lettering, you simply move the sheet until the desired letter is in the proper position and then rub the front of the sheet with a burnisher. When pressure is applied, the letter transfers from the back of the acetate sheet directly to the artwork.



57.15(57B)
Figure 3-36.—Transfer lettering.

Although they can be used without spraying, pressure-transfer letters are usually sprayed with three or four coats of plastic fixative, such as Krylon, if rough or repeated use is required. You can remove a letter with an ordinary pencil eraser if you make a mistake when applying it.

Photolettering Machines

There are several types of photolettering machines on the market for producing display lettering. Some of these machines are the Headliner, Filmotype, Typro, Protype, Morisawa, FotoRex, Foto-Riter, Photo Typositor, Strip-Printer, Alphagraph, U/D Phototypesetter, Foto Type Compositor, Star Lettograph, and ATF Display Photo Typesetter. Most of these machines produce positive or negative copies on film or paper. They are used mainly for display work, although some of them are equipped to produce sizes from 4 point up.

HEADLINER

The VariTyper Headliner is the most common display type photo-composing machine in use in the Navy today. This machine can produce positive copy on 35-mm film or paper. The processing is similar for both the film and paper. Since composition on paper, however, is generally preferred for paste-up purposes, this section will refer to the use of paper when you are operating the machine.

The Headliner produces cold-type photocomposition which is exposed, developed, fixed, and washed completely within the unit.

The copy is produced from a large plastic disk called a TypeMaster. The TypeMaster contains a master negative of all the letters of the alphabet. The negative is laminated on the plastic disk and there are slots cut at the edge of the disk. These slots, or grooves, provide the proportional spacing for the individual characters. There are deep slots for wide letters like "M" and "W" and shallow slots for letters like "i" and "l". (See fig. 3-37.)

Type faces are available in sizes from 10 to 84 points. Most TypeMasters carry a full font of type, however, the larger sizes of type have one disk for the uppercase (capital) letters and another disk for the lowercase letters. These TypeMasters are termed "half fonts."

Before you begin studying the operation of the Headliner, examine the various operator's controls illustrated in figures 3-38 and 3-39.

Machine Set-up

There are several operations that you must perform before you begin to compose on the Headliner. These include preparation of the developer tank, insertion of the paper, and setting of the exposure and spacing controls. Each of these operations is discussed below.

Developing Tank

The exposed paper is fed into the developing tank, which is divided into three separate compartments for the developer, fix, and wash solutions. The developing process is completely automatic; that is, there is no provision to visually inspect the exposed paper during the development process. The paper is carried through the tank by chain-driven sprocket wheels, which are located on the top section of the tank. (See fig. 3-40.)

The developer and fix processing solutions used in the developing tank are mixed according to the manufacturer's instructions. There are two types of solutions: a powder concentrate, which is pre-mixed and stored in amber colored bottles and used as needed; or a liquid solution, which requires no pre-mixing and is ready to use. The wash solution consists of ordinary tap water.

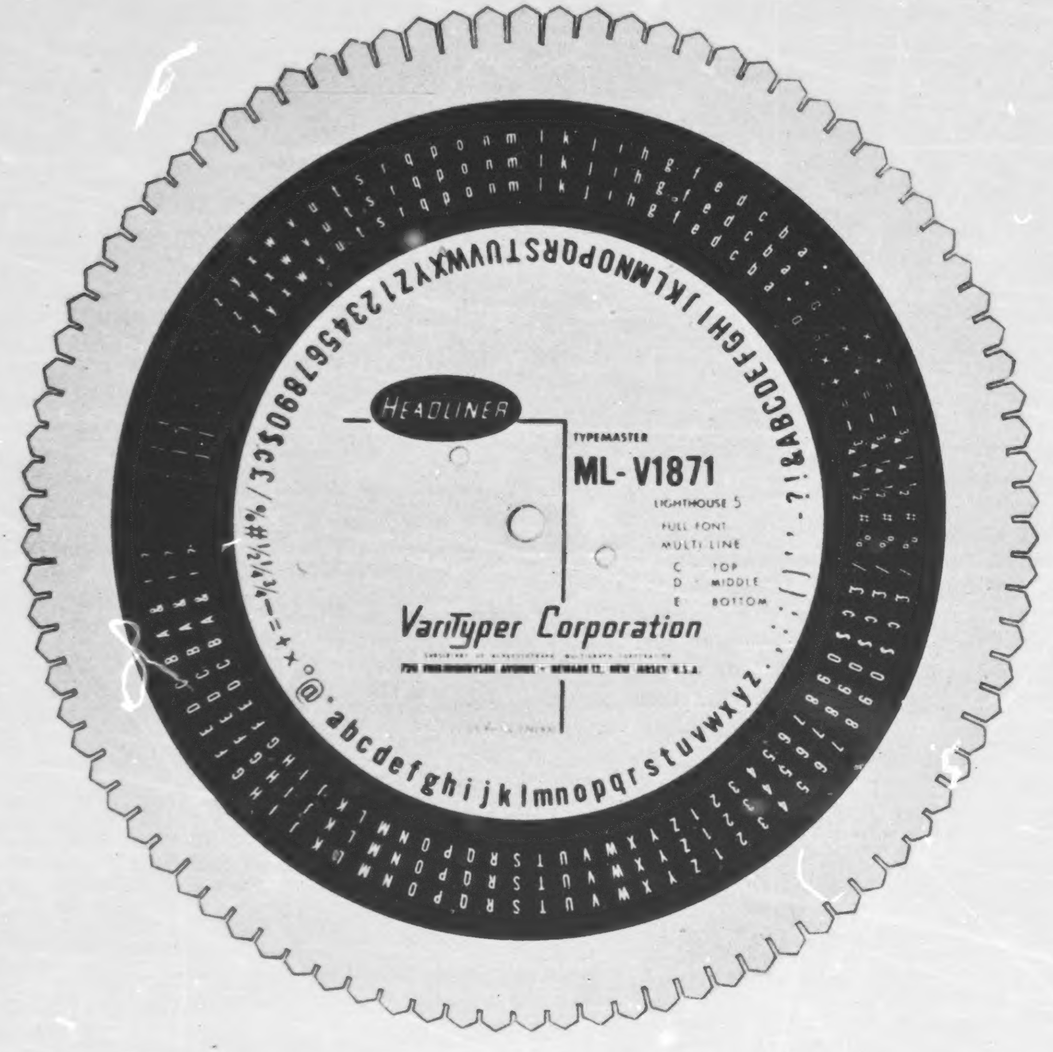
To fill and insert the developing tank into the Headliner machine you should:

1. Pour the developer, fix, and wash solutions into their respective compartments in the bottom section of the tank. Each compartment has an indentation to indicate the proper solution level. (See fig. 3-40.)
2. Place the top section of the tank into the bottom section, by aligning the tab of the top section into the slot of the bottom section.
3. Insert the tank into the machine at the opening on the right side. Make sure the tank is in as far as it will go. (You may find it helpful to have the machine turned on when inserting the tank. This will ensure that the sprockets on the tank will not catch on the chain that drives them.)

Paper Loading

The paper used in the Headliner is packaged in a lightproof cartridge, which is easily inserted into the machine. Refer to figure 3-41, when performing the following steps.

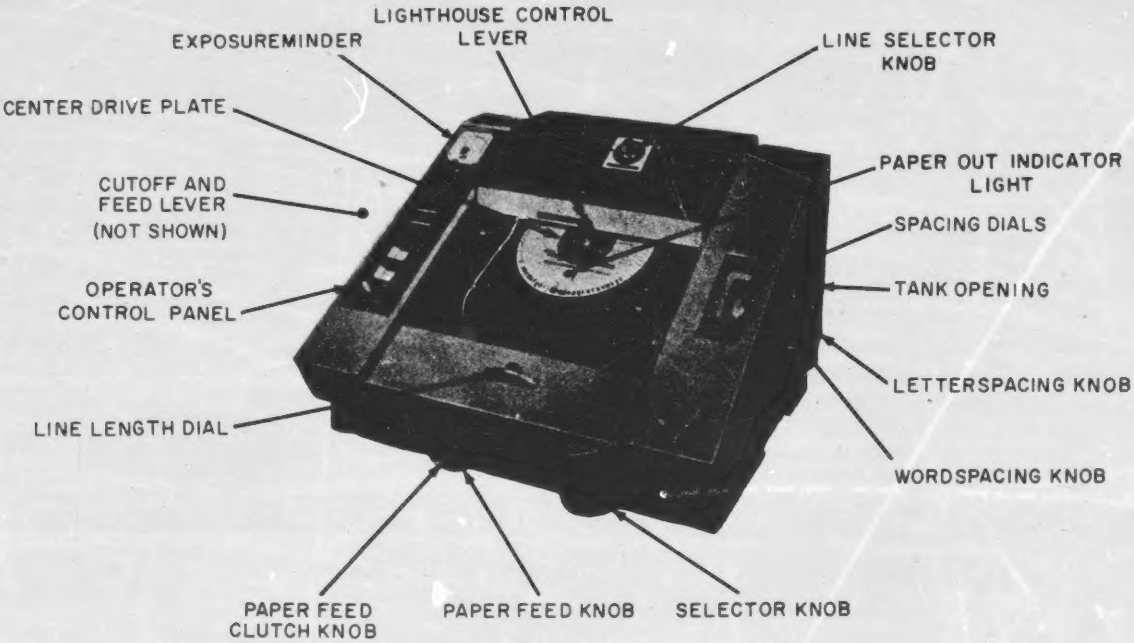
1. Raise the front cover and lighthouse.
2. Pull out the paper feed clutch knob as shown in figure 3-38.
3. Insert the paper cartridge into the well.
4. Raise the paper roller and feed the paper underneath the paper out switch actuator, along the paper channel under the edge of the positioning indicator, underneath the paper guide and into the opening at the left end of the paper channel.
5. Push in the paper feed clutch knob and turn the paper feed knob clockwise and observe the paper feed in the channel. If the paper does not feed along the channel, the paper has not been inserted far enough into the left channel opening. To correct this, pull the paper feed


HEADLINER
TYPEMASTER
ML-V1871
LIGHTHOUSE 5
FULL FONT
MULTI LINE
C TOP
D MIDDLE
E BOTTOM
VariTyper Corporation

142.333X

A. Identification number. First two digits indicate size in points.
B. Lighthouse setting.
C. Font setting

Figure 3-37.—A typical TypeMaster.


LIGHTHOUSE CONTROL LEVER
EXPOSUREMINDER
LINE SELECTOR KNOB
CENTER DRIVE PLATE
PAPER OUT INDICATOR LIGHT
CUTOFF AND FEED LEVER (NOT SHOWN)
SPACING DIALS
OPERATOR'S CONTROL PANEL
TANK OPENING
LETTERSPACING KNOB
LINE LENGTH DIAL
WORDSPACING KNOB
PAPER FEED CLUTCH KNOB
PAPER FEED KNOB
SELECTOR KNOB

57.21.OB(142A)X

Figure 3-38.—VariTyper Headliner 860.

clutch knob out and slide the paper to the left, deeper into channel opening.

6. When the paper is feeding properly, press down on the paper with your hand to remove the bow from the paper in the channel.

7. Lower the paper roller to hold the paper in position.

8. Lower the lighthouse and front cover.

Inserting the TypeMaster

The TypeMaster is positioned under the lighthouse, as shown in figure 3-42. Place the TypeMaster on the large center pin on the drive plate and turn the selector knob until the side locating pins enter the TypeMaster. To ensure that the TypeMaster is firmly seated, press down on it with your hand.

You are now ready to set the lighthouse setting and the wordspacing and letterspacing dials. The correct wordspacing and lighthouse setting are printed on each TypeMaster.

Lighthouse Settings

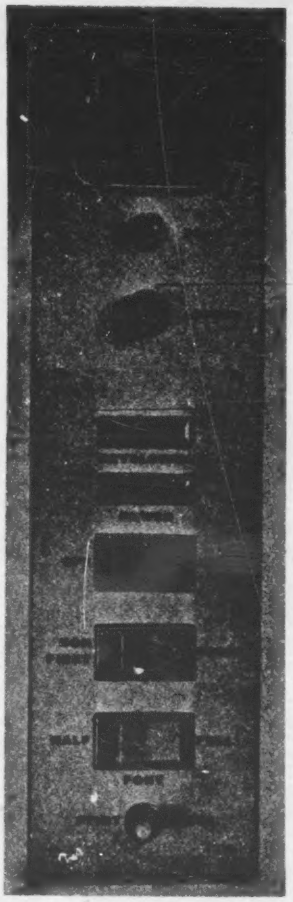
The lighthouse setting determines the amount of light that passes through the TypeMaster to the paper. You must adjust it according to the size of the characters being printed. Too large an opening will cause parts of other characters to print, while too small an opening will not allow the character to print completely.

To set the lighthouse, move the lighthouse control lever, shown in figure 3-42, to the lighthouse setting indicated on the TypeMaster.

Wordspacing

You must vary the space setting according to the size of the letters on the TypeMaster. The unit of measurement used to define the size of the Headliner type is points.

You turn the wordspacing knob, shown in figure 3-43, until the point size on the wordspacing dial corresponds with the point size



142.336X
Figure 3-39.—Headliner control panel.

indicated on the TypeMaster. For example, if you are using a 36-point Typemaster, set the wordspacing dial at 36 points.

Letterspacing

Located next to the wordspacing dial is the letterspacing dial. This dial indicates the amount of spacing that is placed between the individual characters. You can set it with the letterspacing knob, shown in figure 3-43. The normal setting is "0", however, this setting may be advanced or retarded for either a plus or minus spacing. For example, if you find that the space a line or word is to fit into is limited, you can use closer spacing between the letters by setting the letterspacing dial to the "-", or minus side of "0". Conversely, you can stretch a line or word by setting the dial on the "+", or plus, side of "0".

(Note: When setting either the wordspacing or letterspacing dials, always arrive at your desired setting from a higher setting. For example, if you have selected a 24-point TypeMaster, turn the wordspacing dial to a point size greater than 24 points and then come down to 24 points.

In the case of letterspacing, first turn the letterspacing knob so that "-9" is aligned with the dial indicator and then turn back to your desired setting. This method will ensure a precise setting.

Line Length Dial

The dial, shown in figure 3-38, is provided to show the cumulative amount of paper that has been used. It moves when the paper feed knob is turned and you can also move it by hand. You should move it manually if you want to bring the dial to "0" without movement of the paper.

The dial is calibrated in inches and picas to aid in copyfitting measurement calculations.

Line Selector

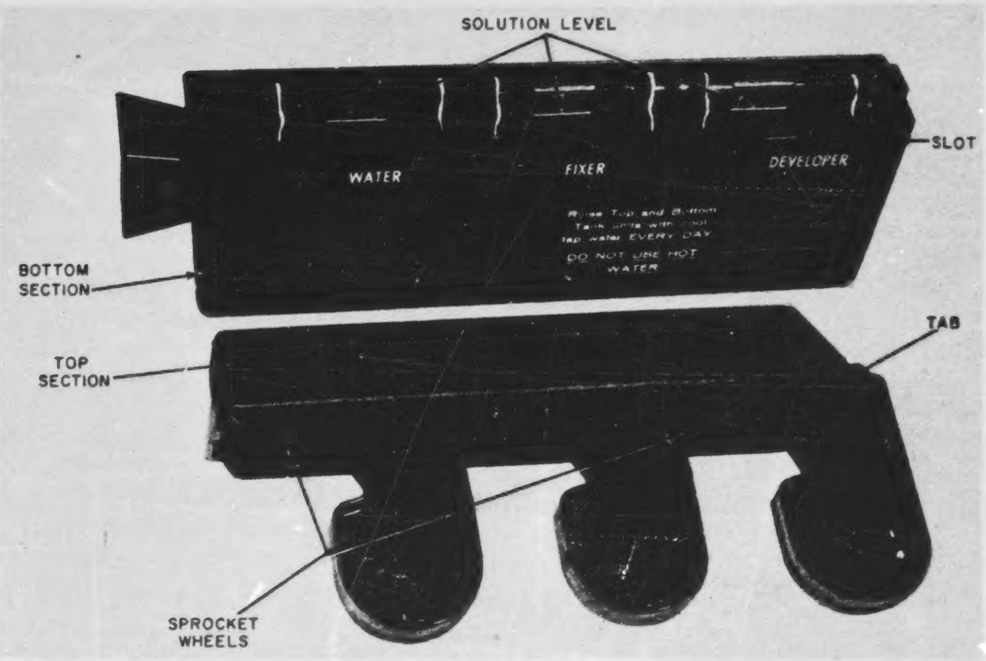
The Headliner Model 860 has the capability to print multiple lines of copy from a special TypeMaster. If the machine you are using is this model, it will have a line selector knob, as shown in figure 3-38.

The selector knob must be in the "N" (normal) position when printing with a Typemaster that has only one line of characters.

Exposureminder

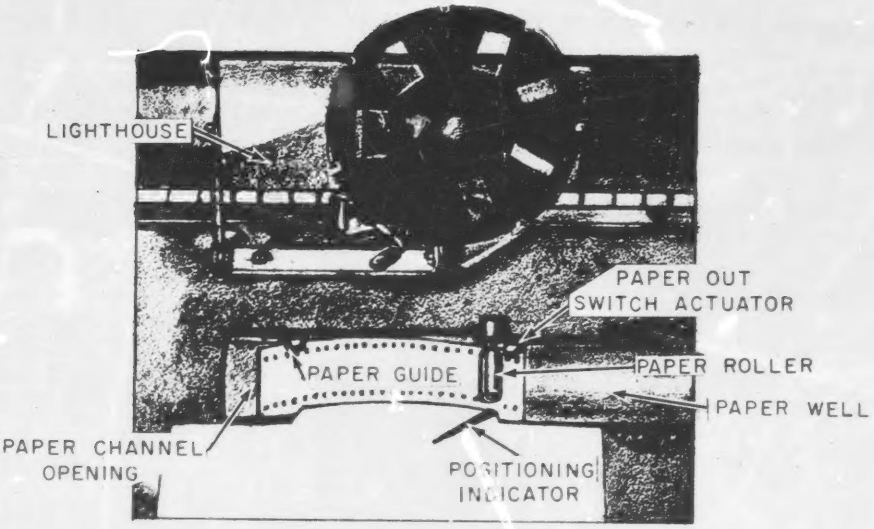
On the front of the machine there is a device called the Exposureminder. (See figs. 3-38 and 3-39.) This meter assists in maintaining a uniform electrical current to the lighthouse lamp, thereby ensuring a uniform light intensity and proper character density.

Associated with the meter are a read pushbutton and an adjust knob, as shown in figure


SOLUTION LEVEL
SLOT
WATER
FIXER
DEVELOPER
Rinse Top and Bottom
Tank units with cool
tap water EVERY DAY
DO NOT USE HOT
WATER
BOTTOM
SECTION
TAB
TOP
SECTION
SPROCKET
WHEELS

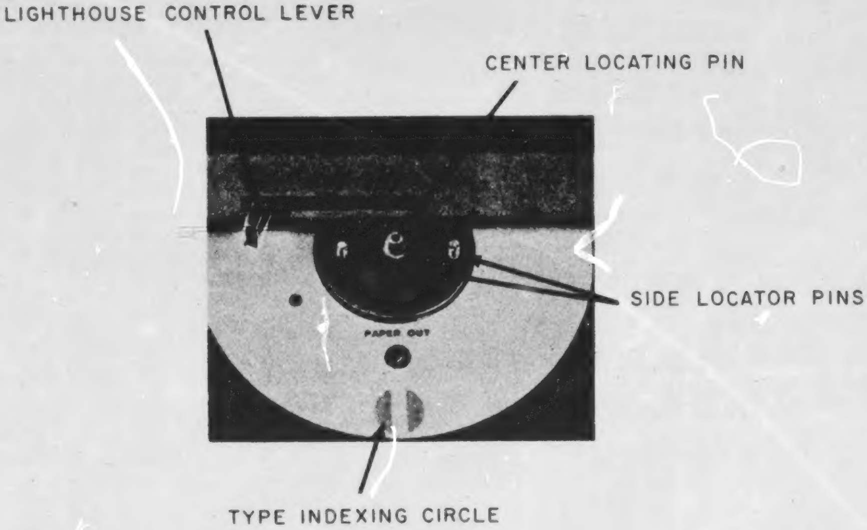
142.331X

Figure 3-40.—Headliner developing tank.


LIGHTHOUSE
PAPER OUT
SWITCH ACTUATOR
PAPER GUIDE
PAPER ROLLER
PAPER WELL
PAPER CHANNEL
OPENING
POSITIONING
INDICATOR

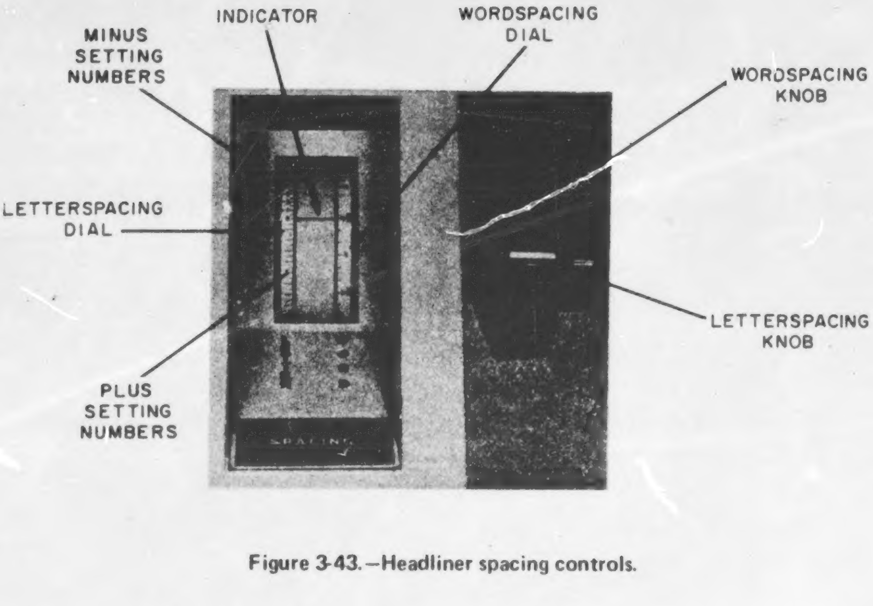
142.332X

Figure 3-41.—Inserting paper in the Headliner.


LIGHTHOUSE CONTROL LEVER
CENTER LOCATING PIN
SIDE LOCATOR PINS
PAPER OUT
TYPE INDEXING CIRCLE

142.334X

Figure 3-42.—Headliner drive plate.


MINUS SETTING NUMBERS
INDICATOR
WORDSPACING DIAL
WORDSPACING KNOB
LETTERSPACING DIAL
LETTERSPACING KNOB
PLUS SETTING NUMBERS
SPACING

142.335X

Figure 3-43.—Headliner spacing controls.

3-39. You depress the read pushbutton when you want to check the value of the lamp current. Because the current flows through the lamp when this button is depressed, the paper directly under the lighthouse is exposed. After checking and/or adjusting the lamp current, turn off approximately one inch of paper in order to pass this exposed portion toward the developing tank.

The adjust knob is used to set the lamp current at the desired level as monitored at the Exposureminder. Five is the normal Exposureminder setting. This setting does not have to be changed for different sizes or styles of characters. It can, however, be adjusted to lighter or darker values to meet particular requirements, such as when underexposure is desirable due to hot developer or overexposure is necessary to compensate for worn-out developer.

Font Switch

The font switch, shown in figure 3-39, has two positions, half and full. Set it at the full position if the TypeMaster you are using contains both uppercase and lowercase letters. If your Typemaster has only uppercase (or lowercase) characters, you should set the font switch at the half position.

Print/Nonprint Switch

Occasionally you will want to know how much space a word or line will occupy before it is printed. When the print/nonprint switch, shown in figure 3-39, is placed in the nonprint position, the lamp in the lighthouse will not expose the paper. By monitoring the amount of paper used with the line length dial, you can determine the amount of space required for your copy. The paper that has not been exposed can be used by disengaging the paper feed clutch and turning the paper feed knob counterclockwise to return it to the paper cartridge. Some operators place a piece of tape over the print/nonprint switch when it is positioned in the print position, to prevent it from being moved inadvertently to the nonprint position. Otherwise, you may find that you have not been exposing the copy you have been composing.

Machine Operation

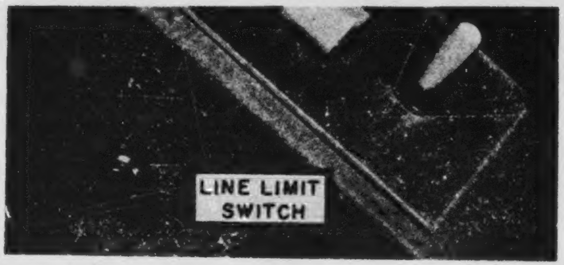
The operation of the Headliner is relatively simple. The first step when operating the machine (assuming the TypeMaster selection and settings just discussed have been made) is to select the character you wish to print. This is accomplished by turning either the selector knob, shown in figure 3-38, or the TypeMaster itself. Position the desired character in the center of the type indexing circle, shown in figure 3-42. Next, momentarily move the print-space switch, shown in figure 3-39, to the print position. Continue this procedure for the remainder of the first word.

To space between the words, move the print-space switch to the space position. When you have completed your composing, turn the paper feed knob until the line length dial has made one complete revolution, plus one inch. (The extra inch ensures that the exposed paper will clear the cutting knife.) Raise the cut-off lever, shown in figure 3-38, and hold it in the up position until the developing light comes on. The paper is now entering the developing tank. The cut-off lever may now be released.

The minimum amount of paper that can be fed into the developing tank is 13 inches. When 13 inches has passed the cut-off lever, the lever cannot be raised. Accordingly, for a short line or word, it will be necessary to feed the paper manually with the paper feed knob until 13 inches of paper has been fed into the storage chamber.

The maximum amount of paper that may be printed and stored before development is 4½ feet. A bell will sound at four feet to alert you that you are within six inches of the paper maximum. If the bell is not heeded, the machine will automatically shut down when 4½ feet is reached. When this occurs, advance the paper with the paper feed knob until the line length dial makes one complete revolution, plus one inch. Then raise the cut-off lever to start the machine and feed the paper through the developing tank.

If you are in the middle of a word when the machine shuts down, you may complete the word by using the line limit switch, shown in figure 3-44. By depressing this switch, you can override the automatic shutdown mechanism.



57.702X

Figure 3-44.—Line limit switch.

After the paper comes out of the machine, it is a good practice to rinse it in plain tap water to remove all traces of the processing solutions. If you are using film, it will be necessary to place the film in a tray of hypo solution to clear it completely. You will learn more about hypo in chapter 6.

Maintenance

The Headliner should be cleaned after each eight hours of use. If not cleaned regularly, the developing tank compartments will accumulate residue from the processing solutions and this will eventually cause problems. (Note: Never use hot water to clean the developing tank. The heat may cause it to warp. A commercial photo cleaner or cool tap water with detergent may be used.)

The TypeMasters may be cleaned with a damp rag. Always store the TypeMasters in a flat position. Avoid placing them in a hot area, as the heat can cause warpage of the plastic disks.

For detailed maintenance and adjustment procedures, refer to the manufacturer's instruction manual. The accompanying troubleshooting chart (Table 3-1), details the most common operational difficulties and their solutions.

Table 3-1.—Headliner Operation Troubleshooting

Problem		Cause		Solution
Blank paper after printing and developing	A.	Chemicals not correctly mixed or in wrong tank compartments	A.	Replace chemicals
	B.	Exposure bulb is loose or burned out	B.	Tighten or replace bulb
Indistinct or grayish characters	A.	Underexposure	A.	Set Exposureminder to a higher setting
	B.	Developing solution has become weak from use	B.	Replace with fresh developer
Characters not sharp	A.	TypeMaster not firmly seated on drive plate	A.	Press TypeMaster down on drive plate
	B.	Overexposure	B.	Set Exposureminder to a lower setting
	C.	Warped TypeMaster	C.	Replace TypeMaster
One side of characters cut off	A.	Incorrect lighthouse setting for TypeMaster used	A.	Re-set lighthouse opening
Characters overlapping	A.	Font switch not in proper position for half font TypeMaster	A.	Move front switch to half font position
	B.	If one character consistently touches the next character, its slot may have dirt in it	B.	Clean slot with knife blade blade or fine file

Table 3-1.—Headliner Operation Troubleshooting—Continued

Problem	Cause	Solution
	C. Bind in paper	C. Check paper feed
	D. Bind in TypeMaster	D. Check rotation of Typemaster; make sure it isn't binding on the lighthouse
Developing light remains on and paper does not come out of developing tank	A. Tank not properly inserted	A. Push tank further in machine
Developing light will not light; paper does not feed into developing tank when cut-off lever is raised	A. Paper jammed in sprocket housing	A. Open back cover and clear sprocket housing
Cut-off lever will not raise	A. Minimum amount of paper (13 inches) has not been used	A. Turn paper feed knob to obtain 13 inches of paper in storage chamber
Machine shuts off	A. Maximum amount of paper passed (4½ feet)	A. Raise cut-off lever to feed paper into developing tank

PROOFREADING

Everyone makes a mistake once in awhile. That is to be expected. That is why one out of every nine men in an automobile plant is a checker—there to catch errors that creep in along the assembly line. All printers check or proofread their copy before it goes to press. In fact, some national magazines are proofread 12 or more times, yet occasional errors still slip by.

So you can see that proofreading is a very important operation. It would be mildly disastrous to let a story go to press reading: "The deeds of the admiral will remain immoral in the minds of seafaring men" when it should have read "remain immortal."

It could be extremely disastrous to let something like this go by: "Commence shore bombardment Blue Beach I 0200Z" when it should have read "Commence . . . 0020Z".

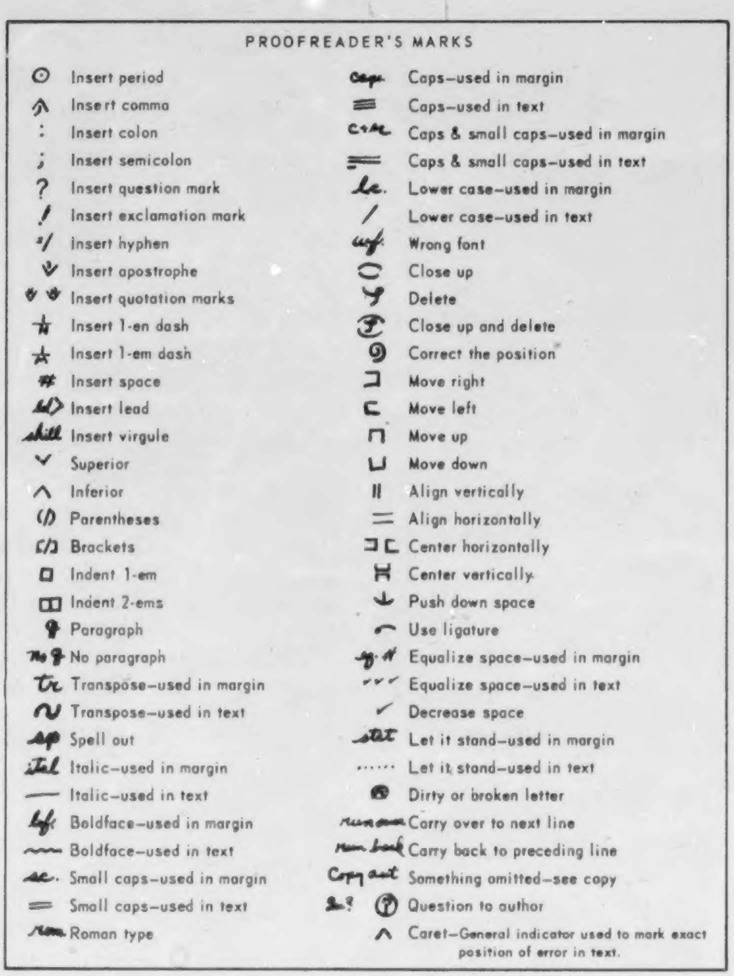
Two men are generally assigned to proofread a job. One reads aloud from the original copy and the other checks the proof. The proofreader does not make any changes except where there are typographical errors such as misspelling of common words, and so on. If he discovers an error of fact in the original copy, he should query it (put a question mark in the margin of the proof) and take it up later with the PO in C.

Always read all punctuation; spell out unusual or proper names; check for paragraph indentions and improper capitalization. You should double check for the transposition of letters such as ie and ei and for homonyms such as way and weigh. Such words sound alike but have different meanings, so be sure to check the spelling in relation to the content.

The Navy lithographer should be well informed on nautical terminology. An excellent list of these terms is contained in *Seaman*, NAVPERS 10120-F.

In addition to checking for such errors as mistakes in spelling and punctuation, you should also check proofs for proper type sizes, proper placement of headings, and proper spacing.

Figures 3-45 and 3-46 show the proofreader's marks and how they are placed on the copy.

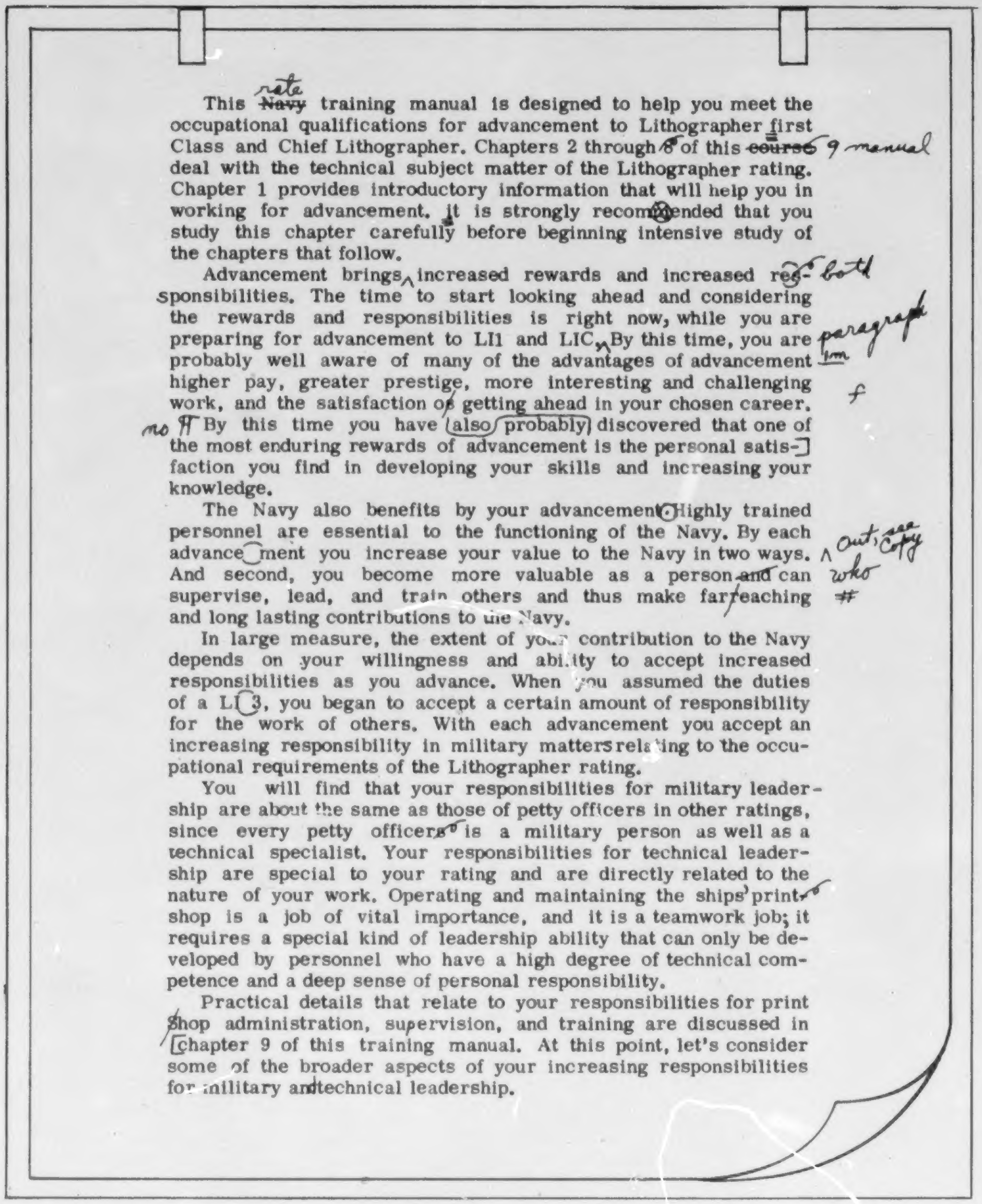


PROOFREADER'S MARKS

⊙	Insert period	caps	Caps–used in margin
∧	Insert comma	≡	Caps–used in text
:	Insert colon	c+sc	Caps & small caps–used in margin
;	Insert semicolon	≡	Caps & small caps–used in text
?	Insert question mark	lc.	Lower case–used in margin
!	Insert exclamation mark	/	Lower case–used in text
=/	Insert hyphen	wf	Wrong font
∨	Insert apostrophe	⊂⊃	Close up
∨ ∨	Insert quotation marks		Delete
	Insert 1-en dash		Close up and delete
	Insert 1-em dash		Correct the position
#	Insert space	⊐	Move right
ld>	Insert lead	⊏	Move left
shill	Insert virgule	⊓	Move up
∨	Superior	⊔	Move down
∧	Inferior	‖	Align vertically
(/)	Parentheses	=	Align horizontally
[/]	Brackets	⊐ ⊏	Center horizontally
□	Indent 1-em		Center vertically
□□	Indent 2-ems		Push down space
¶	Paragraph	⌒	Use ligature
No ¶	No paragraph	eq.#	Equalize space–used in margin
tr	Transpose–used in margin	✓✓✓	Equalize space–used in text
∽	Transpose–used in text	✓	Decrease space
sp	Spell out	stet	Let it stand–used in margin
ital	Italic–used in margin	......	Let it stand–used in text
—	Italic–used in text		Dirty or broken letter
bf	Boldface–used in margin	run over	Carry over to next line
~~	Boldface–used in text	run back	Carry back to preceding line
sc.	Small caps–used in margin	Copy out	Something omitted–see copy
=	Small caps–used in text	Qu? ⓘ	Question to author
rom	Roman type	∧	Caret–General indicator used to mark exact position of error in text.

57.23.0

Figure 3-45.—Proofreader's marks and editorial marks are, for practical purposes, the same. The main difference is in their usage. As a rule, editorial corrections to manuscripts are made directly in the body of the copy. If this is not possible, the corrections are inserted above or below the line and the place where they are to go is indicated by an insert caret (Λ). Proofreading symbols are placed in the margins of hot type proofs so the printer can see them readily, and a caret is placed within the text to show where the correction is to be made. If there are several errors in the same line, the marks should be placed in the proper sequence in the margin of the proof and separated by diagonal lines. If the lines are long, the proofreader divides each line mentally and marks corrections for the left side of the line in the left margin and corrections for the right half of the line in the right margin.



This ~~Navy~~ rate training manual is designed to help you meet the occupational qualifications for advancement to Lithographer first Class and Chief Lithographer. Chapters 2 through ~~8~~ of this ~~course~~ deal with the technical subject matter of the Lithographer rating. Chapter 1 provides introductory information that will help you in working for advancement. it is strongly recommended that you study this chapter carefully before beginning intensive study of the chapters that follow.

Advancement brings increased rewards and increased responsibilities. The time to start looking ahead and considering the rewards and responsibilities is right now, while you are preparing for advancement to LI1 and LIC. By this time, you are probably well aware of many of the advantages of advancement higher pay, greater prestige, more interesting and challenging work, and the satisfaction op getting ahead in your chosen career. By this time you have also probably discovered that one of the most enduring rewards of advancement is the personal satisfaction you find in developing your skills and increasing your knowledge.

The Navy also benefits by your advancement Highly trained personnel are essential to the functioning of the Navy. By each advance ment you increase your value to the Navy in two ways. And second, you become more valuable as a person ~~and~~ can supervise, lead, and train others and thus make farreaching and long lasting contributions to the Navy.

In large measure, the extent of your contribution to the Navy depends on your willingness and ability to accept increased responsibilities as you advance. When you assumed the duties of a LI 3, you began to accept a certain amount of responsibility for the work of others. With each advancement you accept an increasing responsibility in military matters relating to the occupational requirements of the Lithographer rating.

You will find that your responsibilities for military leadership are about the same as those of petty officers in other ratings, since every petty officers is a military person as well as a technical specialist. Your responsibilities for technical leadership are special to your rating and are directly related to the nature of your work. Operating and maintaining the ships' print-shop is a job of vital importance, and it is a teamwork job; it requires a special kind of leadership ability that can only be developed by personnel who have a high degree of technical competence and a deep sense of personal responsibility.

Practical details that relate to your responsibilities for print Shop administration, supervision, and training are discussed in chapter 9 of this training manual. At this point, let's consider some of the broader aspects of your increasing responsibilities for military andtechnical leadership.

57.703

Figure 3-46.—Cold type composition corrections. When marking cold type copy corrections, the proofreader tapes a sheet of tissue over the proof and marks his corrections on the tissue overlay at the point where they occur. The use of the tissue overlay eliminates markings on the copy which would appear on the negative when the copy is photographed.

These marks may vary somewhat in civilian life from shop to shop—but in the Navy, you will use them as they are shown on the chart, and you must know them as part of your qualifications for advancement in rating.

Proofreader's marks are actually a code used to eliminate written explanations to the compositor (the person who sets the type or prepares the cold type composition). For example, when you see the word "stet" on a proof, you know at once that it means, "Don't change this—even though a change was indicated—let it stand as it is."

Some proofreaders draw a line or kite tail from the error in the text body to the margin and write in the correction there. This method is not recommended, however. It should never be used on reproduction proofs or direct-image plates. When you are reading proof on reproduction copy, corrections should be made in light blue pencil in the margin. A water soluble pencil or fountain pen is best for marking plates, as the marks will not take ink when the plate is run on the press and will wash off completely in many cases.

MAKING CORRECTIONS

There are several methods which you may use to make corrections to cold type composition. Occasionally a simple erasure or the application of white opaque correction fluid may do the job. Because of the possibility of show through of the error, most corrections to cold type copy are made by cutting in the correction in the place of the error.

Cut-in corrections are made by placing the copy over a light-table and aligning the correction over the error. (a) A rectangular cut is made through the correction and the original copy with a single edge razor blade or a copy knife. (b) The error is removed from the copy and the correction is placed into the cut out area. (C) If you cut the error and correction at a slight angle, you will prevent the correction from being placed into the cut area upside down. The correction is held in place by tape, which is applied to the back of the copy. With practice, you should be able to make perfectly aligned cut-in corrections in a short time. In figure 3-47, the cut-in correction steps are illustrated.

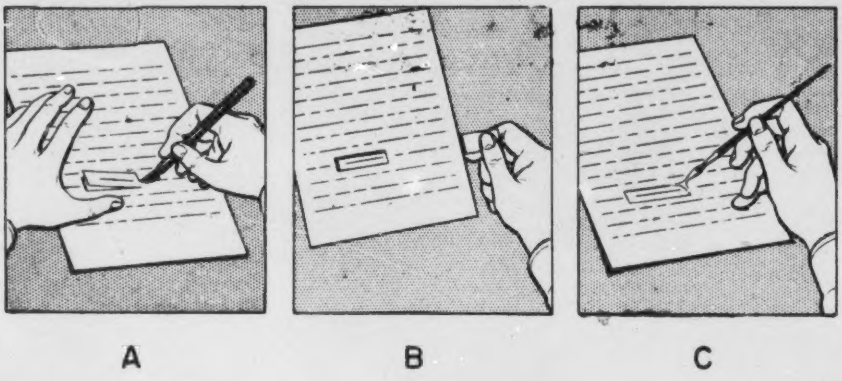


Figure 3-47.—Making cut-in corrections on cold type copy.

CHAPTER 4

ARTWORK PREPARATION

KINDS OF COPY

All artwork falls into one of three general classifications: line, tone, or combination.

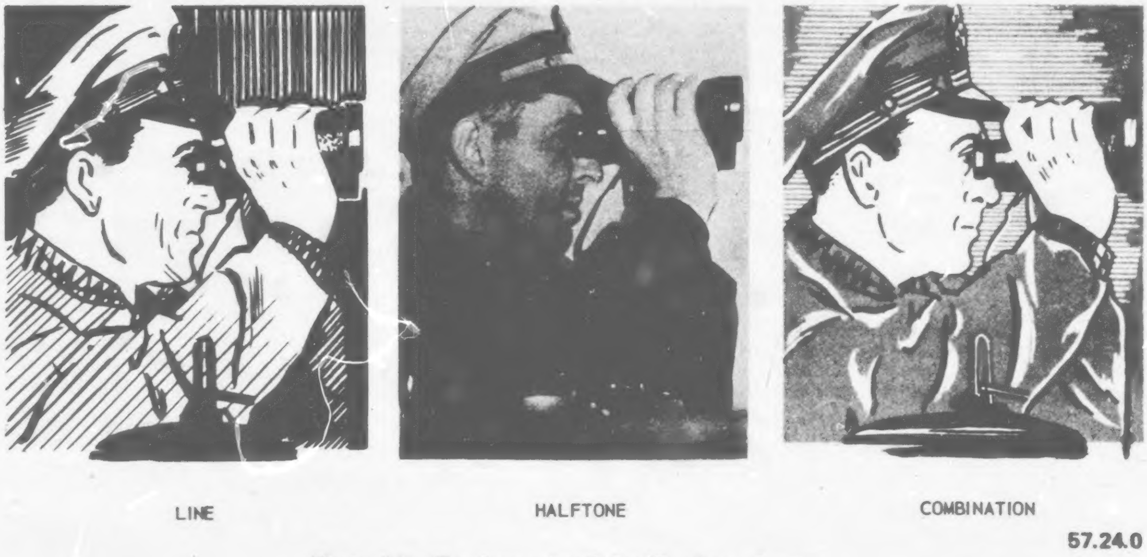
Line copy consists of typewritten material, reproduction proofs, clippings, lettering, pen-and-ink drawings, and any other artwork which will appear as lines or solid blocks of color without gradations in tone. Negatives made from this type of copy are known as line negatives.

Tone copy consists of watercolor drawings, oil paintings, photographs, and other types of work composed of a series of tones that blend together without clear-cut divisions. In order to preserve the shadows and tones found in this type of copy, the cameraman must photograph it through a ruled screen. The screen breaks up the image into a series of tiny dots, like those shown in figure 4-1. These dots are so small that they blend together to give the appearance of continuous tone. Negatives produced by this process are known as halftone negatives.

Combination copy, as the name implies, is art that consists of both tone and line work, as for example, a photograph to which lettering and arrows have been applied. To reproduce the photograph as tone and the lettering and arrows as line, the cameraman must make two negatives—one for the line and one for the tone. These negatives are then fitted or stripped together to produce a combination image when the plate is printed.

Line Work

Line drawings ordinarily print only as lines and solid blacks, but if shading is required, you



LINE HALFTONE COMBINATION

57.24.0

Figure 4-1.—The three general classifications of copy.

can supply it by such methods as crosshatching with pen and ink or by sticking a sheet of patterned acetate over the area that is to be shaded. (See fig. 4-2.)

Preparing Line Drawings

Line drawings are generally done on white paper with black india ink. Dark blue and red ink will also reproduce fairly well, but pale colors such as light blue, gray, or yellow should not be used. Nor should you prepare original drawings on colored papers. Some colors photograph as black or gray, making it difficult for the cameraman to separate the drawing from the background when he makes the negative.

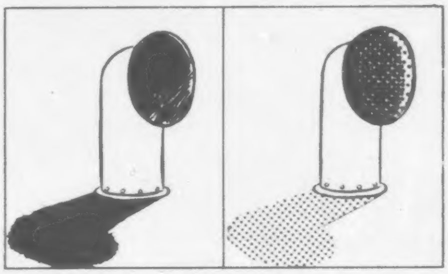
The original drawing is usually prepared for one-half or one-third reduction. That is, it is drawn twice or one and one-half times larger than the printed illustration is to be. The cameraman then reduces the image to the proper size when he makes the negative. Reduction minimizes flaws and gives the work a professional appearance.

When you are making a line drawing, you must keep all pen lines clear and open. If the master drawing will not stand reduction without a breakdown or filling in of lines and detail, you should make a smaller, more simplified drawing. (See fig. 4-3.) If you use acetate shading sheets for tone areas, you must select a pattern that is coarse and open so that the dots will not run together when the job is reduced.

When you are preparing a series of illustrations for a publication, you should draw them all to the same scale if possible. This will improve the appearance of the job and it will also save time in the camera room, since all the art can then be copied with the same camera setup. Lettering on all artwork throughout a publication should be carefully planned to assure uniformity in size after reduction.

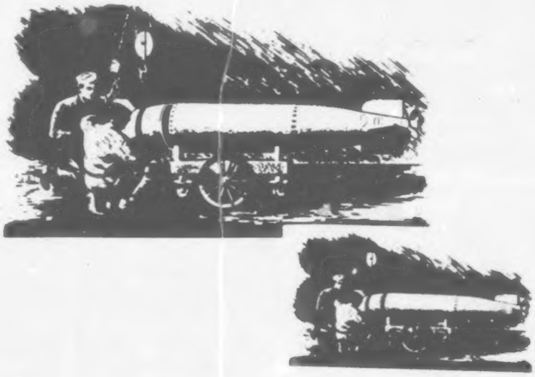
If the artwork is to be enlarged or reduced, you should mark the new width in picas in the margin of the copy, as shown in figure 4-4. If no reduction or enlargement is required, you can simply mark the copy "S/S." or "same size."

Most line copy is shot same size or smaller. Enlargement magnifies defects and gives line work a crude appearance.



57.25.0

Figure 4-2.—Methods of shading a line drawing. Crosshatching was used to shade areas in drawing on left. Mechanical shading was used on the right-hand drawing. The shading patterns were provided on sheets of waxed acetate which were applied to the original drawing and cut to fit the desired area.

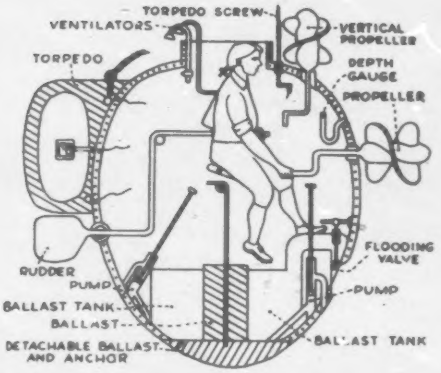


57.26.0

Figure 4-3.—If the lines on your original drawings are not clear and open, they may run together when the job is reduced.

Illustration Board

Line drawings should be prepared on heavy illustration board, or they should be mounted on illustration board. Drawing board varies in thickness from 1- or 3-ply (slightly heavier than postcard stock) to a very thick cardboard. You may use lightweight paper for small drawings, but you should always use the heavier board when you are preparing maps and charts or



57.27.0

Figure 4-4.–How to mark copy for size.

pasting up layouts that will require a good deal of handling. Photographs of line drawings should be mounted on cardboard to facilitate handling, and all artwork should be covered with a paper flap for protection.

Techniques

You should be familiar with the various techniques used by artists in preparing line drawings. Some of these are shown in figure 4-5. Drawing *A*, for example is ordinary pen-and-ink work. *B* is the same drawing done with brush and ink; and *C* is a dry brush drawing. To prepare it, the artist worked on rough paper and used very little ink in his brush.

D was done with crayon and ink on a special type of drawing board which has a pebbled surface. The little dots in this drawing give it a shaded effect similar to that produced by the acetate shading sheets. This illustration is known as a Ross board drawing, because Ross board is the trade name for the paper on which it was drawn. Drawings done on Coquille board are similar in appearance.

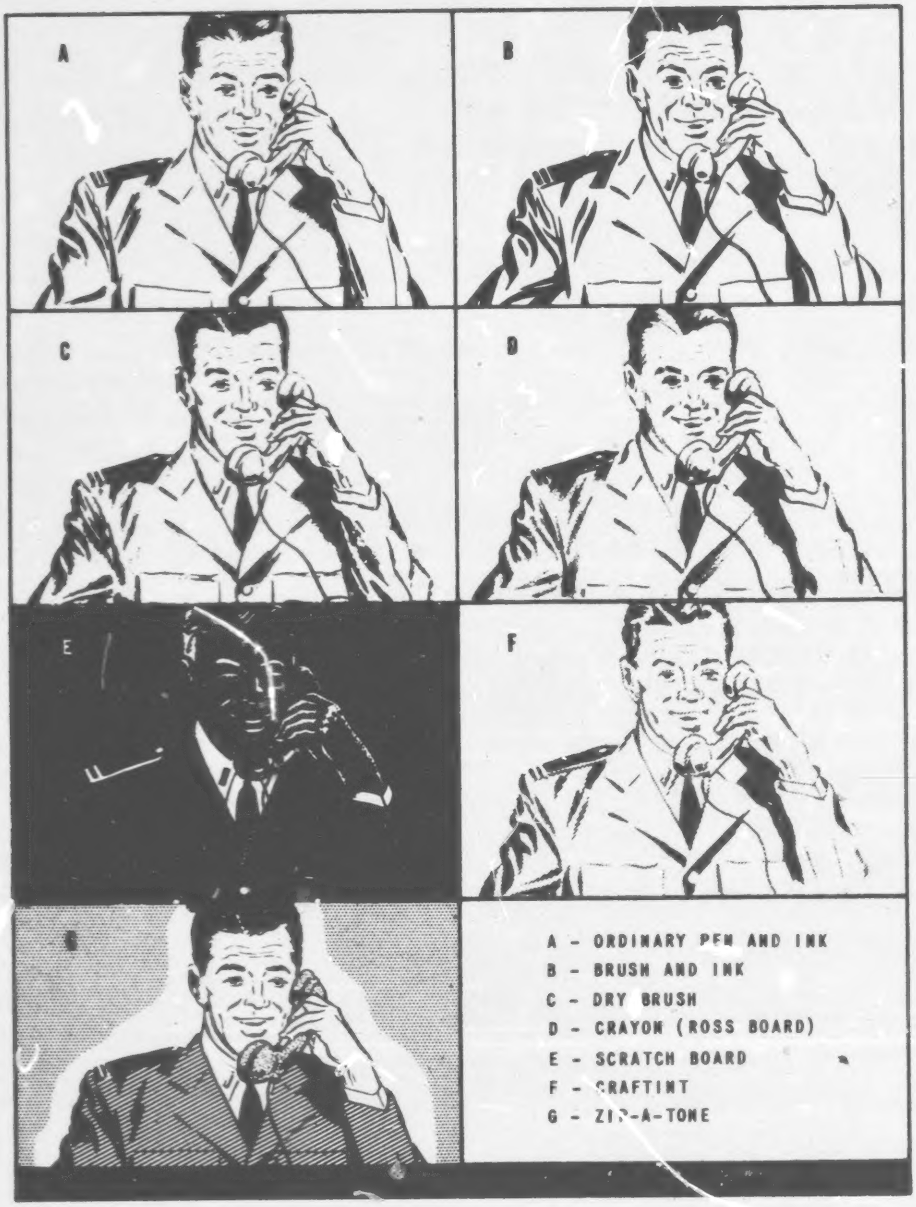
A scratchboard drawing is shown in *E*. Scratchboard is a type of drawing paper which has a smooth, clay surface. The artist first coats the paper with ink and then scratches highlights in the clay surface with a knife. This produces a woodcut effect.

The drawing *F* was done on another type of drawing paper, known as Craft-tint. The surface of this paper is chemically impregnated with an invisible line or dot pattern. The artist first makes a black-and-white line drawing on it in the regular manner and then brushes the areas that are to go in tone with an acid developing solution. This solution brings out the patterns or tones. Craft-tint papers come in single-tone or double-tone patterns. The double-tone patterns require two developers.

Acetate shading sheets were used to produce the tone effects shown in *G*. These sheets are available in various patterns, as you can see in figure 4-6. They are waxed on one side so that they can be applied directly to the drawing paper. After he has positioned the sheets, the artist cuts along the edge of the tone areas with a knife and removes the trim. This process of applying the tone is generally referred to as "applying benday." Benday is a generic term used for all tone effects. It is named after Ben Day, the man who developed the process for applying shading to letterpress cuts. Some of these mechanical shading sheets are known by such trade names as Zip-a-tone, Paratone, Art Type, and Visi-type.

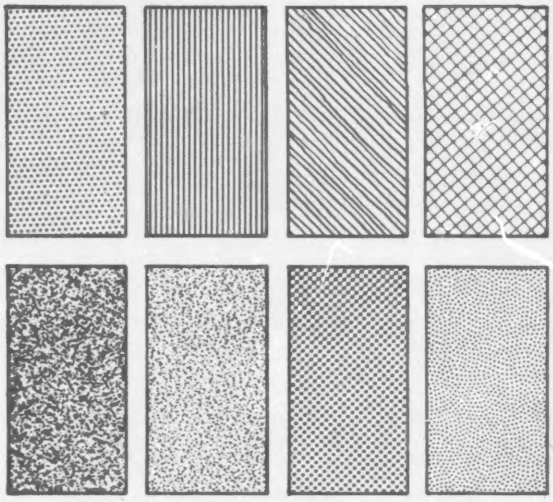
Shading sheets should not be applied to areas where the copy is dirty or patched over, because dirty or patched copy sometimes produces shadows or other defects when it is photographed. These defects can be painted out on the negative in open areas, but little can be done if the area is covered with a series of fine dots or lines. Therefore, if you find that you must place tone over patched areas, it will be better to let the platemaker lay it. You should mark the area in which the tint is to go with a blue pencil on a tissue overlay. A tissue overlay is simply a sheet of tissue paper that is taped to the drawing, as shown in figure 4-7. Overlays enable artists to write instructions and specifications without marking on the copy.

The cameraman can produce tone on film by photographing a sheet of white paper through a halftone screen. These tone negatives are then superimposed on or stripped into the master negative in the areas indicated on the overlay.

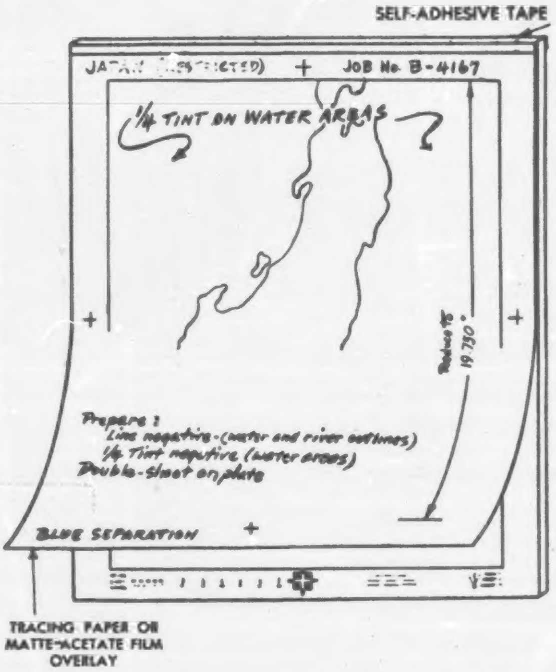

A
B
C
D
E
F
G
A - ORDINARY PEN AND INK
B - BRUSH AND INK
C - DRY BRUSH
D - CRAYON (ROSS BOARD)
E - SCRATCH BOARD
F - CRAFTINT
G - ZIP-A-TONE

57.28.0

Figure 4-5.—Line drawing techniques.



57.29.0
Figure 4-6.—Some of the patterns available on acetate shading sheets.


SELF-ADHESIVE TAPE
JAPAN (RESTRICTED)
JOB No. B-4167
1/4 TINT ON WATER AREAS
Reduce to 19.750"
Prepare:
Line negative-(water and river outlines)
1/4 Tint negative (water areas)
Double-shoot on plate
BLUE SEPARATION
TRACING PAPER OR MATTE-ACETATE FILM OVERLAY

57.30.0
Figure 4-7.—Specifications and instructions may be written on overlays attached to the original artwork.

Clippings and Photographic Prints

When original artwork is not available, you can use clippings of previously printed line drawings as copy. However, if the clippings have been printed in color or if they are printed on colored paper, you should consult your cameraman before submitting them. He can sometimes reproduce color by photographing it through a filter. A filter is a disk (or square) of colored glass, gelatin, or acetate which makes some colors photograph darker and others lighter than the original copy. In some cases, the filter will cancel out the background color, making it photograph as white. In other cases, it will not be possible for the filter to separate the background from the copy, and it will be necessary for you to make a new drawing in black and white.

You can also use sharp, glossy photographic prints of original line drawings or clippings as copy. You may retouch these photographic prints with ink or with black and white watercolors. Smudge marks and fuzziness may be painted out with chinese white, and broken or grayed areas may be sharpened and filled in with india ink.

Production Shortcuts

You can produce a line drawing by tracing over a photograph with pen and ink and then having the photographic image bleached out so that only the inked lines remain. You can also use a mechanical tracing instrument known as the pantograph for producing line drawings from photographs. The pantograph is often used for enlarging or reducing artwork.

Ruling Forms

A large part of your work in the Navy will consist of ruling up forms with pen and ink. You will be using regular draftsman's tools for this type of work. These tools include such items as a drawing board or drafting table, a T-square, plastic triangles and curves, a line gage, a metal ruler, pencils and erasers, drawing and tracing paper, a compass, dividers, knives, razor blades, scissors, and rubber cement.

Draftsman's Tools

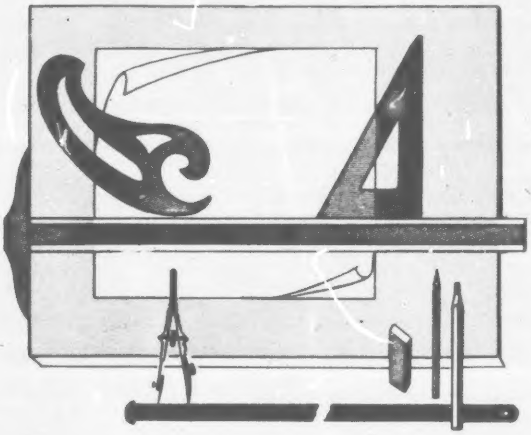
Drawing boards are generally made of pine or some other soft wood. The T-square consists of a long strip called the "blade" and a cross strip called the "head." (See fig. 4-8.) When the head is butted against the side of the drawing board, the blade is squared (at right angles) with the edge of the board. You can use the T-square for drawing lines and for squaring up work on the sheet. You can also use it as a base for the triangle when you are drawing vertical and slanted lines.

Another useful device is the steel straightedge. It is essentially the same as the T-square, except that it has no head. You may use it for drawing long, straight lines, but it is primarily intended as a guide when you are cutting with a knife.

You should never use a knife or razor blade with plastic drafting tools.

Plastic triangles, like the one shown in figure 4-8, are used for drawing vertical and slanted lines. To draw vertical lines, you simply move the T-square to the proper horizontal position and then place the base of the triangle against the blade. You can then draw the vertical line along the side of the triangle.

French curves are used for drawing all sorts of noncircular curves. Actually the french curve is composed of a series of curved sections. Occasionally one of these sections will exactly match the curved line that you wish to use and you can draw your line by simply tracing around the curved area. But more often, you will have to fashion your curve by shifting the guide as you go along.



29.275L

Figure 4-8.—Draftsman's tools.

You can use the compass for drawing circles and arcs. Some compasses have interchangeable parts so that you can use the same instrument for either pencil or ink drawings. Ink compasses are handled much the same as a ruling pen.

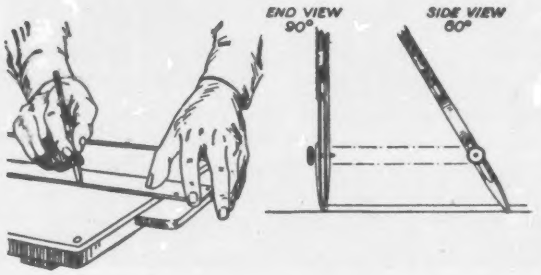
Dividers are similar to compasses except that both legs of the dividers are provided with needle points. They are used for transferring measurements and for dividing lines into equal parts. In layout work, you will find them especially useful in centering headings and checking margins.

Drawing pencils range from 6B (soft and black) through HB (medium) to 9H (very hard). You can use soft pencils, such as 2B or 3B for making heavy, thick lines, but hard pencils should be used for making guide lines and writing in instructions. Drawing pencils do not have erasers. Art gum or kneaded gum erasers are generally used for making corrections and for cleaning smudges and dirt from the surface of the drawing paper.

Most artists use light blue pencils for preliminary and base drawings. It is not necessary to erase blue lines after the sketch has been inked in, as they will drop out during the photographing operation. Red lines photograph as black; other colors vary.

Tracing paper is a thin, tough, semitransparent paper which is available in pads or rolls of varying sizes. Artists generally prepare rough layouts on tracing paper and then transfer them to the regular drawing paper where they are used as a basis for the finished art.

Ruling pens are used for ruling lines of uniform widths. They should be used with T-squares, triangles, and other guides; they should never be used for freehand work. A ruling pen, like that shown in figure 4-9, will produce lines of various widths, depending on the set of the thumbscrew which separates or brings the blades of the pen together. Do not place the ruling pen into the bottle of ink. To fill the pen, you should use the dropper in the top of the bottle.



45.116(57)

Figure 4-9.–Ruling pen. Setscrew regulates the width of the line.

Put ink between the two points of the pen and keep the outside wiped clean to prevent the ink from running. Always keep your ruling pen clean when it is not in use. A dirty pen will produce a ragged line.

You should hold the ruling pen so that the setscrew is away from you. The pen should be almost upright with a slight tilt in the direction you are drawing.

When you are called on to draw up a ruled form, you should square the sheet on the drawing board or table with the T-square. Then fasten the paper to the board with draftsman's masking tape, a brown crinkly paper that peels off readily without injuring the surface of the drawing paper.

Pencil in outlines lightly, using the T-square for all horizontal lines and the triangle for all vertical lines. After the outline has been carefully laid out in pencil, go over it with the ruling pen. Once the form has been inked in, you can remove the sheet and type in the copy. Of course, if you prefer, you can type the copy on a separate sheet of paper and cut it out and paste it into place after the boxes have been inked in. You may also type the copy on the sheet before you rule in the form.

If you are interested in further information regarding line drawings or the use of the ruling pen, you should read *Illustrator Draftsman 3 & 2*, NavTra 10469.

Handle With Care

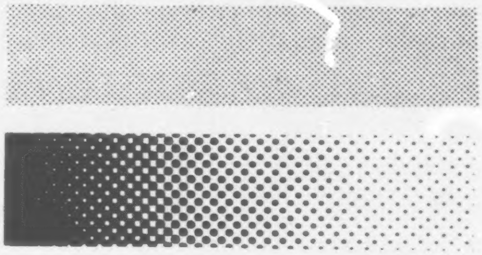
Line drawings are not as critical as tone copy. In halftone work, every smudge, brush stroke, paste-up shadow, or even a fingerprint may show up on the printed sheet. But in line work, only the blacks will print. Shadows and other defects will be burned out during photographing, or they may be painted out afterwards on the negative, provided they do not fall within tone areas.

Tone Copy

You have seen how the artist can introduce flat, gray tones into his line drawings by the use of shading sheets. The shading sheet dots or lines print as solid and are just as black as the darkest portions of the copy. But since they have white space around them, they look gray. (The eye mixes the white with the black and subdues its color.) Printers rely on this optical illusion for producing tints and tones in single-color printing.

Benday shading process generally produces flat, gray tones because the dots are all the same size. (See fig. 4-10.) As you can see in the illustration, if some of the dots are made larger than the others, they will appear darker. This is because the larger dots cover more of the paper and there is less white space between them. The halftone process is based on this principle.

You cannot accurately reproduce the many half shades and tones found in photographs with solid blacks and flat, gray benday shadings. To reproduce a photograph accurately, you must



57.31.0

Figure 4-10.–Tones produced by a series of small dots. The tone above looks flat or even because all the dots are the same size. The bottom tone looks darker on the left side because the dots on that side are larger than the others and have less white space between them. Halftones are composed of dots of varying sizes.

break the entire copy into a series of dots. And the dots must be of varying sizes so that some will appear darker than the others and thus produce an uneven or graduated tone like that found in the original.

The cameraman breaks the copy into dots by photographing it through a screen having a series of crosslines. These crosslines form a pattern that breaks up the light as it passes through the camera, causing it to register on the film as a series of small individual dots, each varying in size according to the amount of light being reflected from the copy at that particular point. Like the benday shadings, these dots blend together to produce an overall gray tone. But since these dots are of varying sizes, they produce a series of tones ranging from light gray to black.

Tone copy includes, besides photographs, drawings rendered in pencil, crayon, charcoal, wash, watercolor tempera, oil, and airbrush. Figure 4-11 shows illustrations produced by some of these media.

Photographs

The requirements for tone drawings and photographs are similar. They should be crisp, sharp, and clear. Glossy photographic prints are better for reproduction purposes than dull (matte-finished) prints. Blurred and faded prints will not reproduce properly and should not be used.

Retouching

It is often necessary to retouch photographs to bring out the details desired, to paint out objectionable backgrounds, or to heighten contrast between blacks and whites.

Retouching is generally done with a regular watercolor brush and retouch watercolors, which consist of seven shades of gray as well as chinese white and lampblack. You can mix them to match the color of the photograph. The colors should tend toward brownish rather than bluish tones.

If the surface of the photograph is not receptive to water colors, you should rub it with a piece of cotton and a powder called fuller's earth.

Retouching must be done with the process of reproduction in mind, since coarse halftone screens necessitate greater contrasts of light and shade. If the cameraman uses a fairly coarse screen when he copies the original, the dots will be large and part of the detail will be lost. Therefore you needn't worry about faint brush marks, as they will be lost in screening. But if the screen is fine, the brush marks may show up in the finished job. With a little experience, you will be able to tell what will reproduce and what will not.

Retouching with the Airbrush

Perfectly smooth backgrounds may be had through the use of an airbrush, a delicate watercolor spray gun about the size of a fountain pen. (See fig. 4-12.)

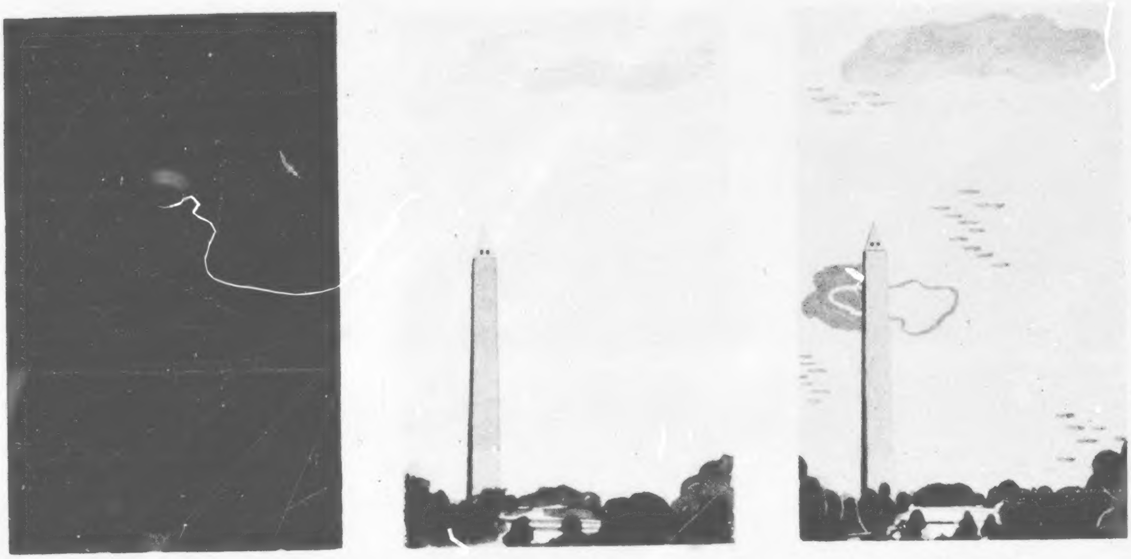
Thinned retouch color is placed in the color cup of the airbrush which is attached to a hose from an air compressor. When the air-control lever is depressed, the air escapes through the point, siphoning the color from the color cup, and with the aid of the needle, shooting it out in a fine spray, like an atomizer.

You can mask off the individual working areas on the photograph with paper stencils, called friskets. Frisket paper is a thin, transparent, waterproof paper. Some frisket papers are self-adhesive; others must be applied to the photograph with rubber cement. You can cut out the working areas with a knife or razor blade.

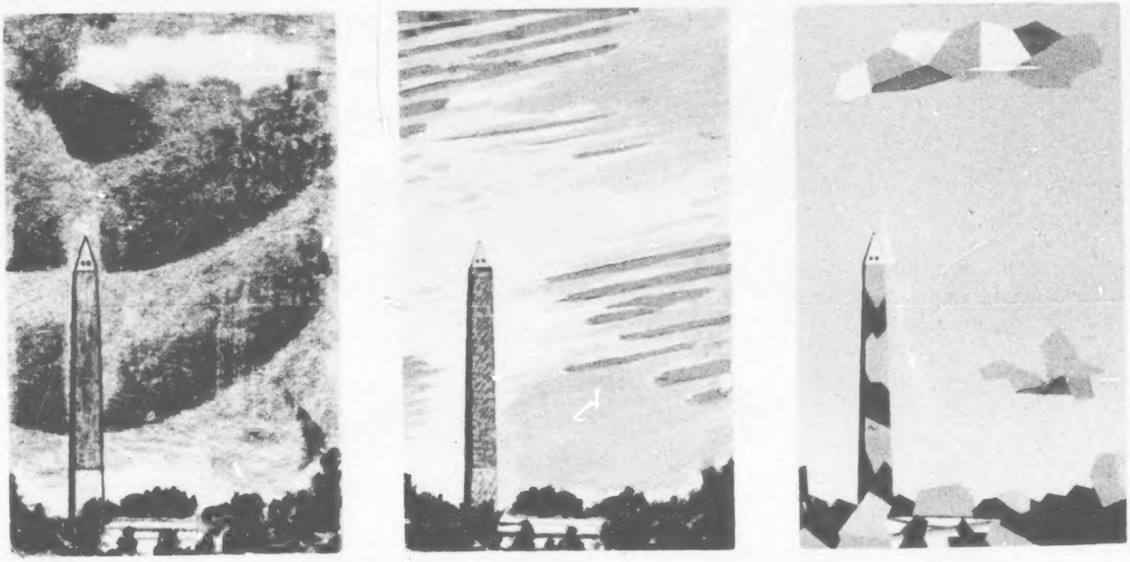
After you have completed the airbrushing, you should peel off the frisket paper. Then remove all rubber cement from the surface of the print by rubbing it carefully with a ball of dried cement.

Airbrushing is particularly useful for retouch work on photographs having a cracked or damaged emulsion. To prevent the crack from showing in the finished job, you should cover the photograph with a sheet of transparent acetate and do your retouching in that area on the acetate. Since the acetate is transparent, the other details of the photograph will show through readily when the job is photographed.

The airbrush is also useful in preparing photomontage work. A photomontage is a group of separate photographs pasted together to produce



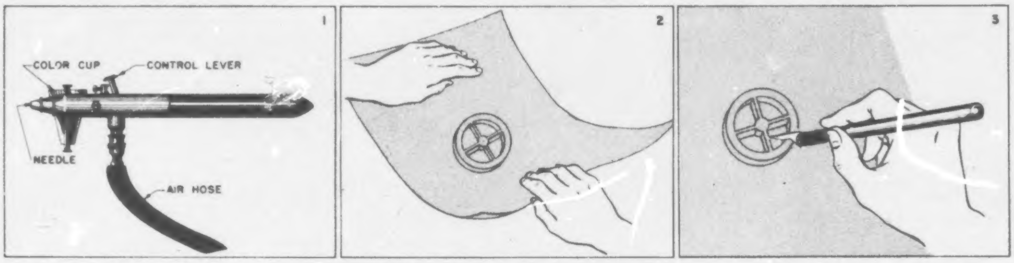
PHOTOGRAPH WASH TEMPERA



CHARCOAL OIL AIRBRUSH

57.32.0

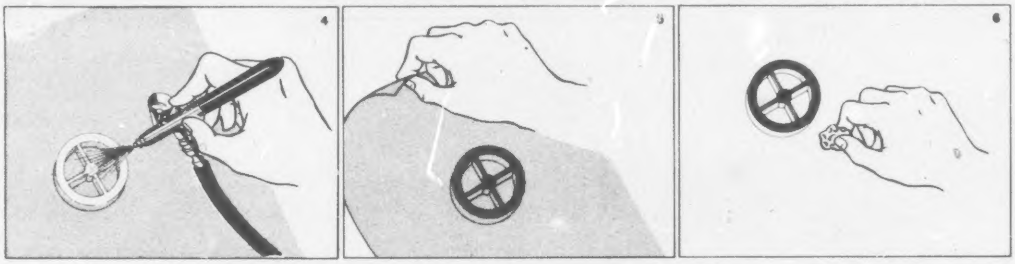
Figure 4-11.—Types of tone copy.



THE AIR BRUSH IS A VERY DELICATE SPRAY GUN USED FOR ILLUSTRATIONS AND PHOTOGRAPH RETOUCHING

INDIVIDUAL WORKING AREAS ARE MASKED OFF ON ILLUSTRATION BOARD OR ON A PHOTOGRAPH BY MEANS OF THIN, TRANSPARENT, WATERPROOF FRISKET PAPER. SOME FRISKET PAPERS ARE SELF-ADHESIVE, OTHERS MUST BE APPLIED WITH RUBBER CEMENT.

THE WORKING AREAS ARE THEN CUT OUT WITH A KNIFE OR RAZOR BLADE.



COLOR IS SPRAYED ONTO THE OPEN AREAS. A CIRCULAR MOTION IS USED TO INSURE SMOOTH, EVEN COLOR DISTRIBUTION. TONES ARE BUILT UP BY SPRAYING OVER AN AREA SEVERAL TIMES. SPRAYING TOO LONG IN ONE SPOT WILL CAUSE COLORS TO RUN.

AFTER THE AIRBRUSHING HAS BEEN SATISFACTORILY COMPLETED, THE FRISKET IS PEELED OFF.

IF RUBBER CEMENT WAS USED IN APPLYING THE FRISKET, IT SHOULD BE CAREFULLY REMOVED BY GOING OVER THE ENTIRE SURFACE WITH A BALL OF DRIED RUBBER CEMENT.

57.33.0

Figure 4-12.—Illustration showing the use of the airbrush. The airbrush is screwed onto an air hose which is attached to an air compressor. When the control lever is depressed, the needle is pulled back, allowing air to escape through the point. The flow of air siphons or draws thinned water color from the color cup, and with the aid of the spinning needle, shoots it out through the point in a fine spray like an atomizer.

a single picture. After they have been pasted up, they are rephotographed and the new print is retouched with the airbush to blend them all together.

Photographs Should be Mounted

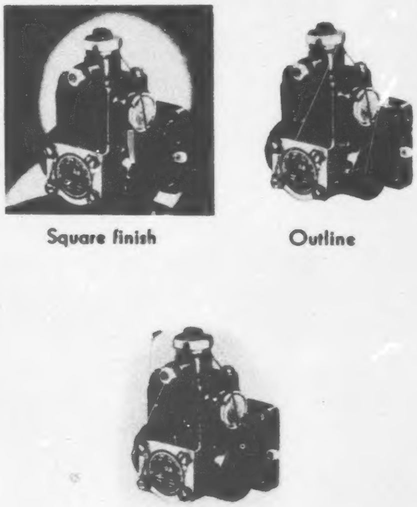
Photographs should never be rolled or folded. They should be mounted on stiff cardboard in a photographic dry-mounting press. If the dry-mount press is not available, you can mount them on cardboard with rubber cement.

Polaroid photographs should not be mounted with rubber cement, as it is liable to damage the photograph. Some types of glue will also damage photographs after a period of time. You can use wax to mount all types of photographs, provided your ship is equipped with a waxing machine. Retouched photographs should be protected with a paper flap. You can attach the paper to the back of the cardboard and fold it over the face of the illustration.

Halftones are generally designated as square finish or outline. Square finish halftones are the conventional square or rectangular forms that you see used every day. Outline halftones are those in which the background has been cut away or eliminated. (See fig. 4-13.) The vignette is another type of finish which has soft, feathered outlines that blend into the surrounding white space of the page. Although they were once very popular, vignettes are seldom used today.

Cropping

When you want to reproduce only a portion of a photograph, you should crop (mark off) the unessential parts. You can mark the margins of glossy prints with grease pencil or ink. (See fig.



Square finish

Outline

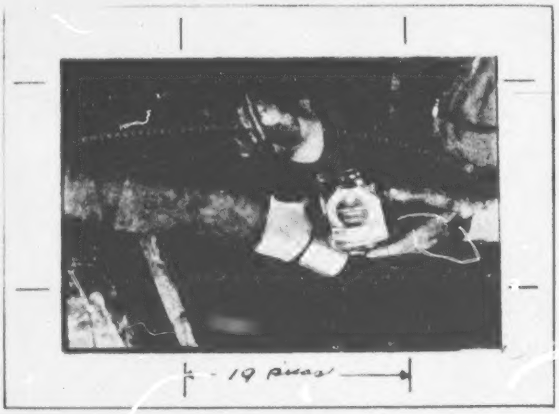
Vignette

57.34.0

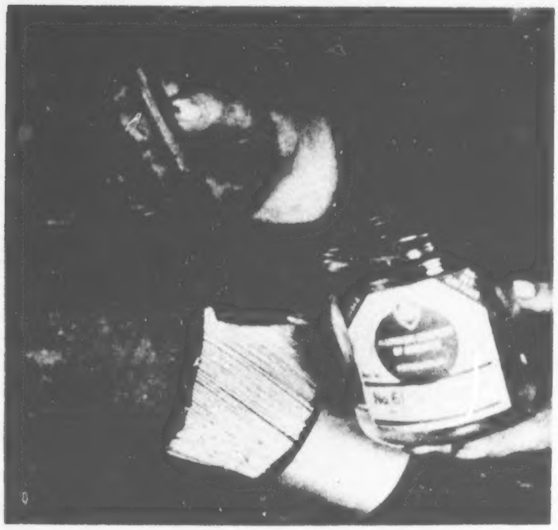
Figure 4-13.—Halftone finishes.

4-14.) Some cameramen prefer copy that has been marked with ink, since the grease pencil tends to come off on the glass of the copyboard when the job is photographed. You may also indicate the section of the picture to be used by outlining it with chinese white, as shown in figure 4-15. Grease pencil marks may be removed later with a dry cloth or eraser, and the chinese white may be removed with a damp cloth. It is difficult to completely remove the ink marks, but you can lighten them with a damp cloth or eraser. Or you can cross them out, if it is necessary to re-use the photograph with new markings.

When a section of a valuable photograph or of a dull, matte-finish print is to be reproduced, you may mask it off by covering the whole picture with a sheet of paper and cutting a window to expose the desired area. If the photograph is to be reduced or enlarged, the exact width must be marked in picas in the margin of the copy. (See fig. 4-14.) Same-size photographs should be marked "S/S" in the margin.



PHOTOGRAPH BEFORE CROPPING. CROP MARKS ARE MADE IN THE MARGINS OF THE COPY TO INDICATE TO THE CAMERAMAN THE AREA TO BE USED.



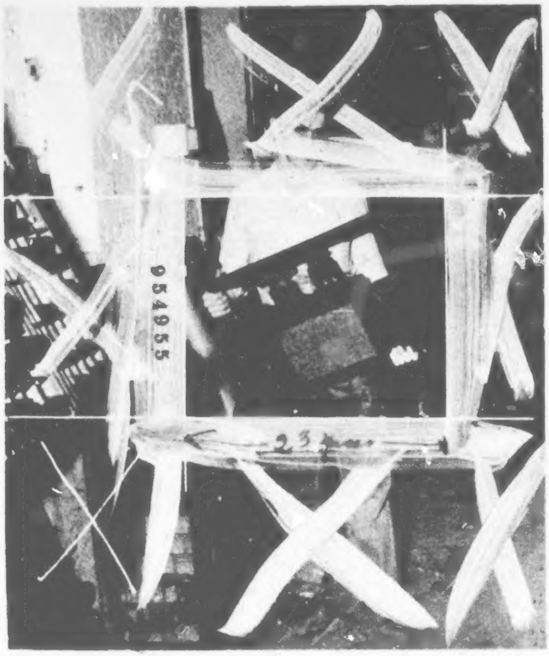
PROOF FROM NEGATIVE MADE FROM CROPPED PHOTOGRAPH.

57.35.0

Figure 4-14.—How to crop a photograph.

Scaling

The same system that you use to scale copy for reduction may be used for scaling photo-



57.36.0

Figure 4-15.—Photograph cropped with chinese white outline.

graphs. You must always remember that when the width of the photograph is increased or decreased, the height is also increased or decreased proportionately. When you know the width, you calculate the new depth by using the following formula:

$$\frac{\text{original width}}{\text{increased or decreased width}} = \frac{\text{original height}}{\text{increased or decreased height}}$$

Suppose you wish to reduce a piece of copy that is 3 inches wide and 6 inches deep to fit a space that is 2 inches wide. To find the new depth, you simply substitute the figures in the formula:

$$\frac{3}{2} = \frac{6}{X}$$

Cross-multiplying, you get

$$3X = 12, \text{ or } X = 4.$$

Therefore, your new depth will be 4 inches.

Scaling may also be done with a slide rule, scaling wheel (circular slide rule), or any one of many patented devices available. Instructions for the use of these devices are usually printed on the face of the dials.

Tone Drawings

Tone drawings are generally prepared for one-half or one-third reduction. In preparing them, you should use the same rules for scaling, marking, and so on, that you use in working with photographs.

Tone drawings should be crisp and sharp. If they are flat and lacking in strength, they will not reproduce properly. Wash drawings are generally done with lampblack and water on a white drawing paper having a slight tooth.

It is better not to do drawings for black-and-white reproduction in colors—especially show-card colors, because these colors usually appear muddy and photograph as either too dark or too light.

It is difficult to copy colored photographs, oil paintings, and pastel drawings for black-and-white reproduction because the colors do not photograph true. Film emulsions are more sensitive to some colors than they are to others and consequently some colors photograph too dark while the others photograph too light. To help balance the colors, the cameraman often photographs colored copy through a filter. Filters, as you have already seen, alter color values making some colors photograph darker and others lighter than the original copy.

Crayon drawings generally give good reproduction. Charcoal and pencil drawings are sometimes difficult to copy.

Clippings

When original drawings or photographs are not available, good glossy photographs of original drawings may be used as copy. Clippings or photographs of clippings of previously screened halftones may also be used. If the halftone dots in the clipping are coarse, the cameraman may be able to copy the clipping as a line shot. But if the original screen was fine and the dots are indistinct, the clippings must be rescreened and the copy should be marked "halftone." Clippings never reproduce as well as the original copy. When clippings are rescreened the dots from the old screen often overlap the new dot formation to form a disturbing pattern called moire. You will learn more about this in chapter 8.

Transparencies

A transparency is a photograph printed on glass or film, sometimes in color and sometimes in black and white. Transparencies have wide use in color separation work, but they are used less often as copy for black-and-white reproduction. To make a negative from a transparency, the cameraman places it in direct contact with the emulsion side of a piece of film and exposes the two to a weak, diffuse light. Transparencies may also be placed in a light box and copied with the camera. You will learn more about them in succeeding chapters of this book.

Special Effects

You may inject additional interest into a page by the use of oversize or bleed illustrations, insets, or combinations of tone and line.

Bleed Illustrations

A bleed illustration is one that has no margin of white space between it and the edge of the paper. In other words, it runs off the page. An illustration may bleed on all sides or it may bleed only on one, two, or three sides.

When an illustration is to bleed, it must be marked so that after reduction, it will be at least 1/8" wider and higher than it is to appear after the page has been trimmed. Since some of it will be cut off when the page is trimmed, you must see that nothing important (such as the name on a map) comes too close to the edge of the copy.

Since bleed illustrations usually require larger paper stock and need considerably more care in production, they are more costly and are seldom used in Navy publications.

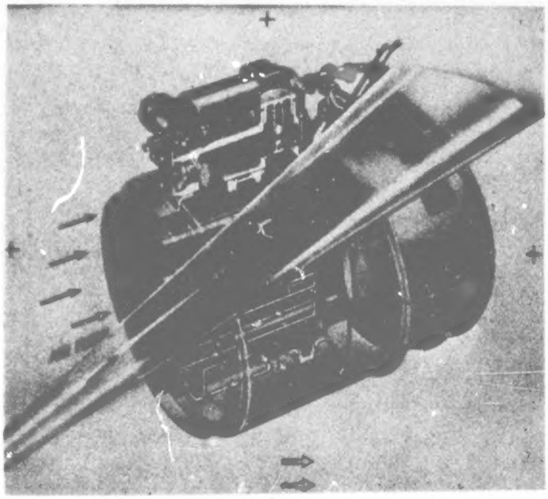
Insets

An inset is a small picture inserted into a larger one. To accomplish this, you should crop the inset and indicate the area on the larger photograph where it is to go by rubber-cementing a piece of black paper (the size of the inset) to the larger photograph. This will produce a transparent area in the negative of the larger photograph which will enable the stripper to position the inset visually. If the inset is to be enlarged or reduced in size, you must scale it accurately so that it will fit the space allotted. Attach a tissue overlay sheet to the photograph and write in on the overlay exact instructions for the cameraman and stripper.

Combination Copy

When lettering or other line work is to be combined with a photograph (or any kind of tone drawing) the photograph should be mounted first on a piece of cardboard, as previously described. You can then cut out the type and paste it directly on the photograph or you can attach an acetate overlay to the photograph and paste the type on the overlay. (See fig. 4-16.)

Pasting the type directly on the photograph is more economical than the overlay method be-



57.38.0

Figure 4-16.—Line copy prepared on an acetate overlap for a combination job.

cause it enables the cameraman to shoot the entire job as a straight halftone. However, it has two disadvantages.

1. The lettering in the finished cut is likely to be fuzzy and indistinct, since it will be broken up by the halftone screen.
2. Shadow lines may appear in the finished illustration around the pasted-up areas, and there is no way to remove these shadows.

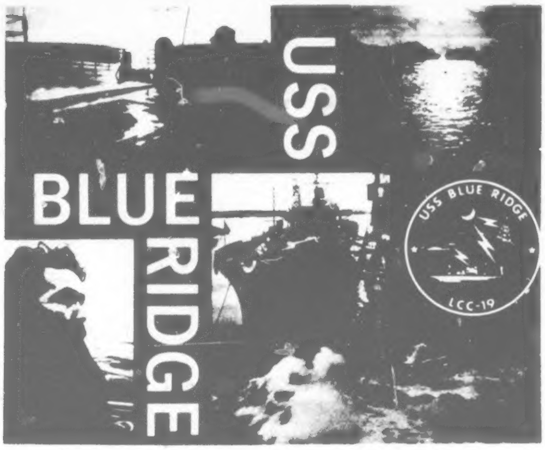
Therefore when you are looking for quality, you should prepare your line copy on the acetate overlay and mark the job "surprint."

When lettering or artwork is done on an overlay, the overlay should be keyed to the photograph (master) with register marks to aid in proper positioning. The crop marks may be traced onto the overlay to serve as register marks, or standard register marks (+) may be applied in the margins of both the photograph and the overlay. (See fig. 4-16.)

Clippings or photographs of printed combination work may also be used as copy. They may be shot as regular halftones or as combination work, depending on the effect desired.

Reverse Combinations

When you wish to reverse the type so that it will print white against a black background, as shown in fig. 4-17, you should mount a good reproduction proof or a line of paste-up lettering of the desired type face on a sheet of stiff drawing paper and draw a border in red ink to indicate the dimensions of the black area. Then instruct the cameraman to make a positive from the type.



57.705

Figure 4-17.—Example of reverse lettering.

Reverses can also be made on shaded or photographic backgrounds, as you can see in figure 4-17. They may be enlarged or reduced if necessary during the copying process. You will learn more about them in chapter 8.

COLOR WORK

The chances are that you will not be doing much color work in the Navy. However, it is a good idea to be familiar with the processes used for preparing copy for color reproduction.

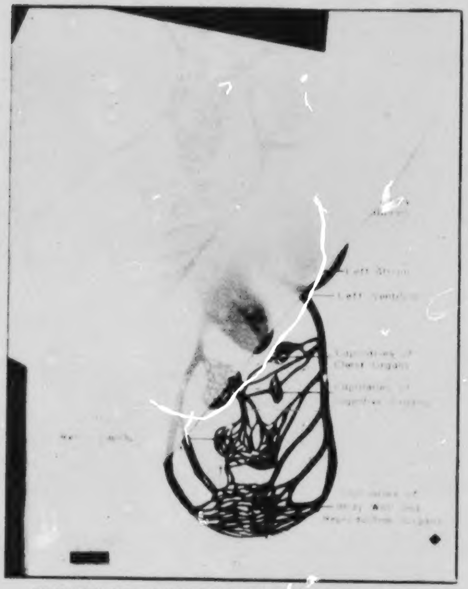
Methods of preparing line copy to be printed in color are shown in figures 4-18 through 4-20. A simple black-and-white drawing is all that is required if the colors do not overlap. To guide the cameraman in making the color separation, you should attach a tissue overlay to the original drawing and fill in on the tissue with colored pencils all the areas that are to be in color.

The cameraman will then shoot as many negatives from the original as necessary to reproduce the number of colors desired. Then, using the overlay as a guide, he will make his color separations by masking out on each negative all but the areas that are to print in one particular color. From these masked-out negatives, he will make the plates for each color.

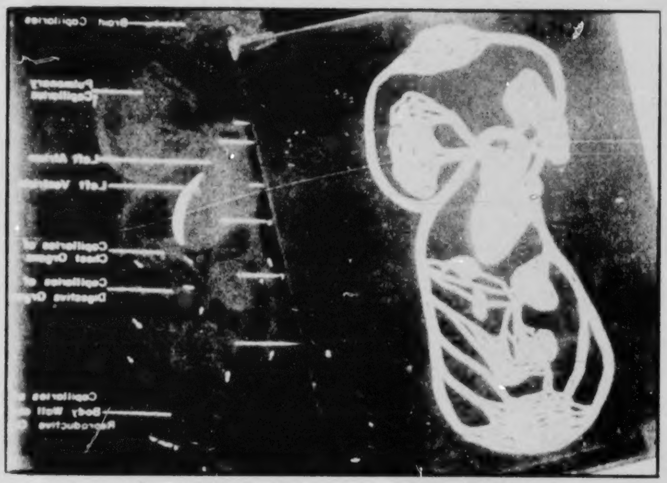
Color Blocks and Tint Areas

Background color generally consists of color blocks or tints. These color areas may be filled in with india ink on the original drawing or you may simply indicate where they are to go by outlining the area on the original drawing with red ink. You should then block in the area on a tissue overlay, as shown in figure 4-19.

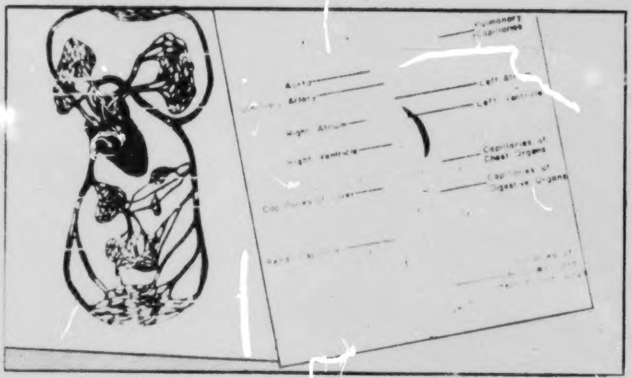
The cameraman will then make two negatives and mask out parts of each to produce the color separation plates. When asking the cameraman to supply a tint, you must always indicate on the overlay or on the original art, the tone value required. A 25 percent tint means 25 percent of



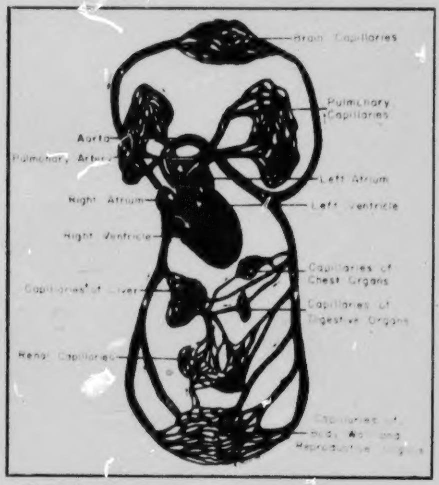
WHEN COLORS DO NOT OVERLAP, THE CAMERAMAN CAN MAKE LINE-COLOR SEPARATIONS FROM A SIMPLE BLACK-AND-WHITE DRAWING. TO GUIDE HIM IN MAKING THE SEPARATIONS, YOU SHOULD ATTACH A TISSUE OVERLAY TO THE ORIGINAL DRAWING AND FILL IN ON THE TISSUE WITH COLORED PENCILS THE AREAS THAT ARE TO GO IN THE SECOND COLOR.



THE CAMERAMAN WILL THEN SHOOT TWO NEGATIVES FROM THE ORIGINAL DRAWING, AND USING THE OVERLAY AS A GUIDE, WILL MASK OUT ON EACH NEGATIVE ALL AREAS THAT ARE NOT TO GO IN THAT PARTICULAR COLOR.



THE PROOFS FROM THE RESULTING PLATES WILL LOOK LIKE THIS


Brain Capillaries
Pulmonary Capillaries
Aorta
Pulmonary Artery
Left Atrium
Right Atrium
Left Ventricle
Right Ventricle
Capillaries of Chest Organs
Capillaries of Liver
Capillaries of Digestive Organs
Renal Capillaries
Capillaries of Body Wall and Reproductive Organs

THE RESULTING TWO-COLOR JOB WILL LOOK LIKE THIS

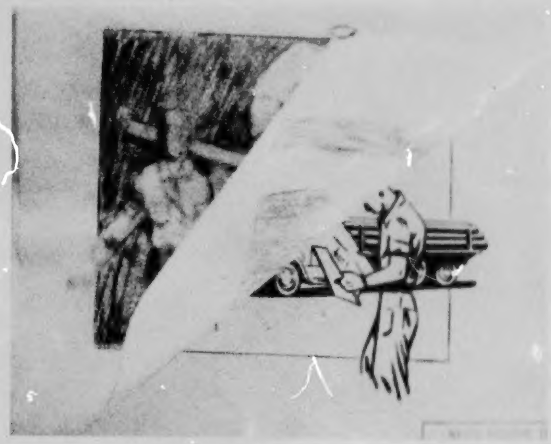
57.39

Figure 4-18.—How line-color separations may be made from a simple black-and-white drawing. Original drawing should carry register marks.

the paper will be covered by dots and 75 percent will be left as white space. As a rule anything below 25 percent is rather light for color work, especially if the tint is to be printed in a light color of ink. You will learn more about tints in chapter 8.

When Colors Overlap

If the colors are to overlap, you should make a key drawing in black (the main color) on a sheet of white illustration board. Then attach an acetate overlay to the key drawing and draw on



57.40

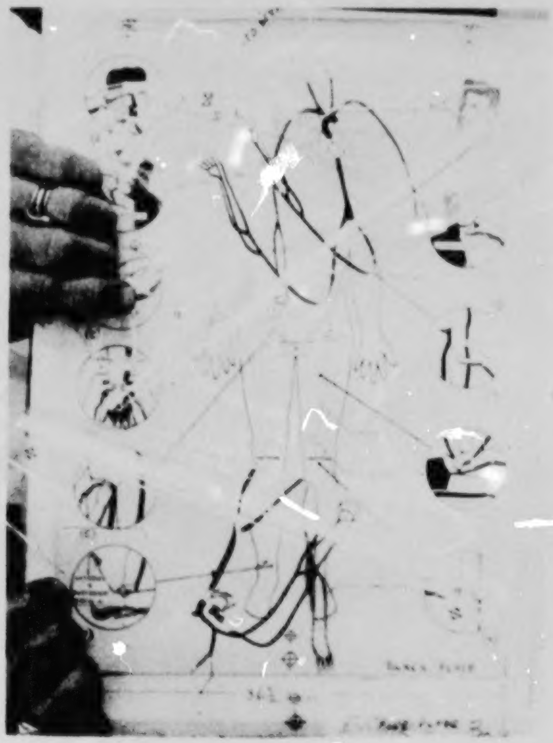
Figure 4-19.—How the artist indicates areas for color blocks and tints. In illustration shown here, black and white copy is prepared on a sheet of illustration board. A red outline has been ruled on the original to show the area of the color or tint block. The artist has attached a tissue overlay to the original drawing and has indicated with colored pencil on the overlay, the area that is to go in color.

the acetate the parts that are to print in the second color. If the job is to be run in more than two colors, use a separate acetate overlay for the artwork for each additional color. (See fig. 4-20.) Tracing paper may be used as an overlay if acetate is not available, however it is not as suitable for this purpose because it tends to wrinkle when ink is applied to it.

Halftone Color Separation

Halftone color separation negatives may be made from copy consisting of color photographs, color film transparencies, watercolor drawings, drawings done in showcard colors or tempera, pastel drawings, and oil paintings.

As a rule, you should not attempt to separate the colors when you prepare tone copy for color reproduction. You can simply furnish the cameraman with full-color drawings and photographs and leave the job of color separation entirely up to him.



57.41

Figure 4-20.—Illustration showing how artwork is prepared for a job when the colors overlap. The base drawing is made on illustration board in black and white. Areas that are to go in color are then prepared on separate acetate overlays which are attached to the original drawing. The original drawing and the overlays must carry register marks. (Figure 7-10 shows how to prepare an overlay for a two-color job.)

INSTRUCTIONS TO THE CAMERAMAN

Before sending artwork to the cameraman, you should review it carefully to see that all instructions are clear and concise.

Be sure that all crop marks are plainly indicated and that all illustrations have been properly scaled and marked for size. In the case of full-page illustrations, be sure that there is enough space for the legend or cut line at the bottom of the page. (See fig. 4-7.)

Also check to see that special instructions for insets, tints, blocks, reverses, and so on, are clear and that overlays have been properly marked. If illustrations are to go in color, acetate overlays should be marked with the proper color designation, such as red plate, blue plate, and so on. If your unit is large, you should attach a color swatch to the original drawing to show the pressman the colors to be used.

Each piece of art should be marked "line," "halftone," "surprint" or "combination" according to the preferred reproduction treatment. Tone copy should also be marked "outline," "square finish," or "vignette."

If you have several pieces of art, each should be marked for identification by job number or title. Figure numbers or plate numbers should also be assigned to and marked on the flap of each piece of art. Assemble the pieces of art in sequence and then number them consecutively.

PASTE-UP

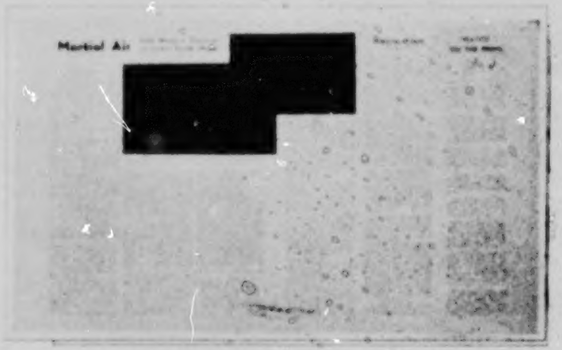
Coldtype compositions, reproduction proofs, photocomposition, and pastedown lettering may be used in preparing text and headline copy for lithographic printing. It is a good idea to assemble the copy and paste it up as a complete page or unit before sending it to the cameraman.

When facilities permit the use of regular type, a page form should be made up just as it is for letterpress printing. Rules, borders, and heads, should all be included, but the artwork may be omitted. Blank spaces should be left in the form where the art is to be placed.

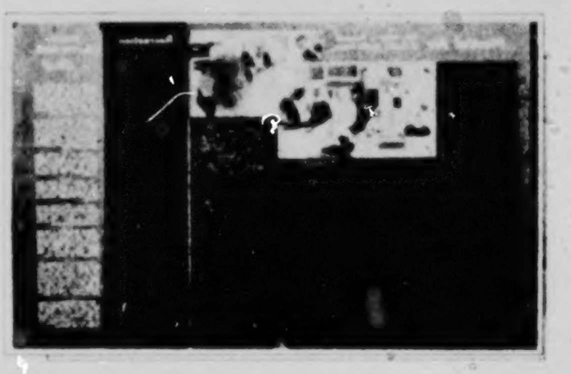
Reproduction proofs pulled from the type form may be used as the master copy for the cameraman. You should mount the proofs on heavy cardboard and then touch up imperfect letters with india ink and chinese white. Next, mount all line drawings that do not require enlargement or reduction in the blank spaces on the master copy. You cannot mount illustrations that are to be enlarged or reduced or illustrations that are to be shot as halftones, because these illustrations require different camera setups. They must be photographed separately and stripped into the master negative.

Instead, you should mask out on the master copy the areas where these illustrations are to appear. You can do this by pasting black paper over the areas, as shown in figure 4-21. You should than attach a tissue overlay to the master copy and indicate on the tissue which illustration is to go in each masked area.

When the master copy is photographed, the masked portions will show up on the negative as "windows" or transparent areas. The tone work is then shot separately and the line drawings are shot to the proper scale. The negatives thus



MASTER COPY. THIS ONE CONSISTS OF REPRODUCTION PROOFS. NOTE MASKED-OUT AREAS FOR HALFTONE ART AND PASTED-UP LINE DRAWING AT TOP OF "WATCH ON THE BRINE" COLUMN. IF THE OFFSET PLATE IS LARGE ENOUGH IT IS A GOOD IDEA TO LAY OUT YOUR PASTE-UP COPY IN TWO-PAGE FORMS.



MASTER NEGATIVE MADE FROM ABOVE COPY. HALFTONES AND BENDAY AREAS HAVE BEEN STRIPPED IN.

57.42

Figure 4-21.—Camera-ready paste-up and negative obtained from it.

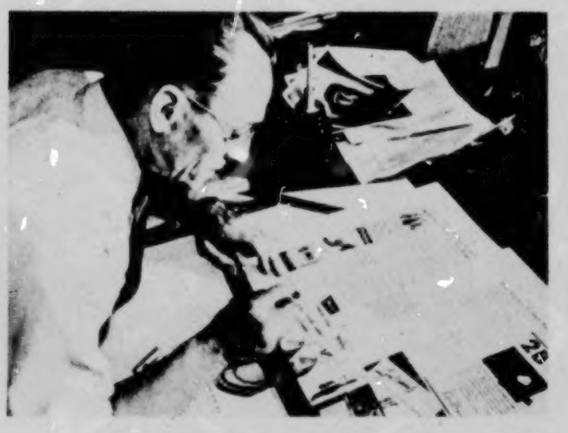
produced are then stripped into the master negative, as shown in the illustration. Stripping in this case, consists of placing the "strip-in" negatives or inserts into the proper windows on the master negative and securing them with strips of red cellulose tape. Figure 4-21 shows a master negative after it has been stripped up.

Makeup With Coldtype Composition

When coldtype composition is used as copy, paste-up work is more involved. In this case, you must rule up a sheet of heavy stock with a T-square and blue pencil to show the type area, trim size, bleed, and column widths. Always use a light blue pencil for preliminary ruling because the blue lines will drop out when the copy is photographed. Before pasting up the sheet, you should go over the blue lines with a ruling pen and india ink to supply column rules, borders, and other elements that you wish to retain.

You should then carefully trim the copy to column size and mount it on the layout sheet with rubber cement. Use the T-square to aline the columns. (See fig. 4-22.)

If the coldtype composition has been prepared on a wide measure so that it can be reduced when it is photographed, the entire layout must be enlarged proportionately. Reducing the width of the line also reduces its height. Therefore, the layout must be made longer as well as wider than the job is to be when it is printed. The method of scaling for enlargement or reduction has already been discussed.



57.44X

Figure 4-22.—Pasting up a page of coldtype composition.

Headlines may consist of reproduction proofs, of lines composed on a photo-lettering machine; or of paste-up letters. You may paste them directly onto the master layout unless they are to be enlarged or reduced. Same-size line drawings may also be mounted on the original layout, but tone work and line drawings that require reduction or enlargement must always be shot separately.

Rubber Cement

Always use rubber cement or wax for pasting up copy—never use glue. Rubber cement, which is actually rubber dissolved in a solvent, should be of the proper consistency to adhere to the paper surface without penetrating or staining it. If the cement is too thick, you can thin it with cement thinner. It is needless to add that rubber cement is flammable, so don't try to dry it by holding a match under the copy.

Rubber cement has certain characteristics that make it especially suitable for paste-up work. It is tacky enough to hold the copy in place, yet it doesn't set hard like glue. You can peel the copy up and remove it if necessary without a great deal of damage or effort.

You can apply rubber cement to the back of the copy and position the copy on the illustration board before the cement dries or you can apply the cement to both the copy and the drawing paper and allow both to dry before positioning the copy. You will find that dried rubber cement surfaces still have an affinity for each other. Attach one corner of your copy to the illustration board and then aline it with the T-square before pasting it down.

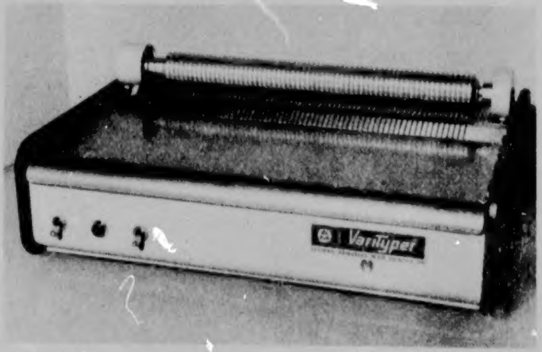
After the copy has been mounted on the drawing paper, you should clean up the layout with a ball of dried rubber cement and an art gum eraser. The ball will pick up the excess rubber cement and the eraser will remove smudges and dirt.

Waxing Machine

Figure 4-23 shows a waxing machine. This machine should be turned on at the beginning of each day and turned off at the end of the day. As soon as it heats sufficiently to melt the wax it is ready for use. Copy is fed face up through two rollers on the machine. The lower roller carries the wax and waxes the bottom of the copy.

Wax has several advantages over rubber cement. It is quicker to apply and it is easier to move the copy in case you mount it in the wrong place on the layout and later have to move it to another area.

In addition to the waxing machine shown in figure 4-23, there are small hand waxers available which are handy for small quantities of work.



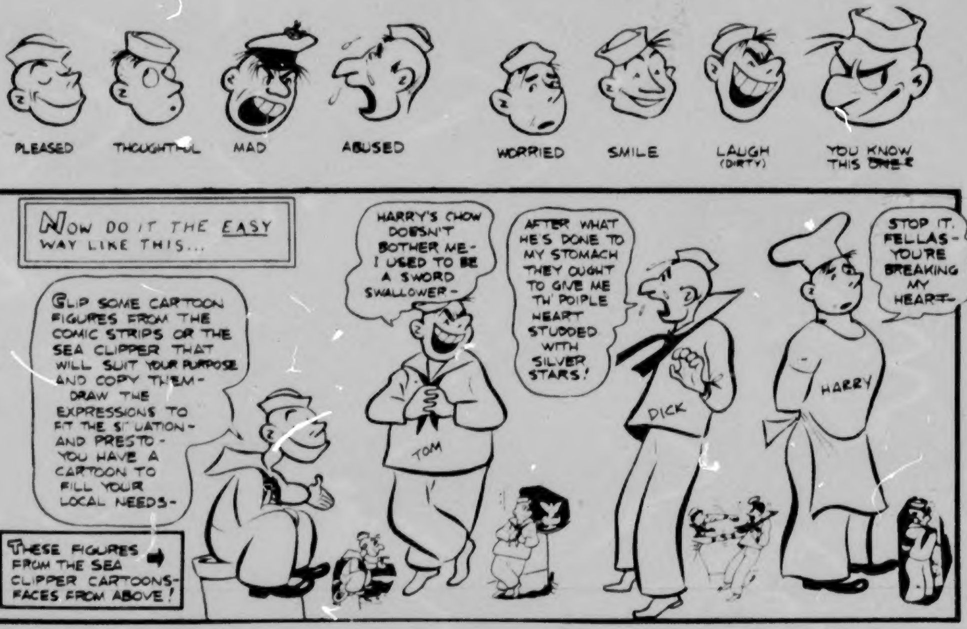
57.581

Figure 4-23.—Waxing machine.

REFERENCE MATERIALS

This chapter has covered the mechanical or production end of the preparation of artwork for offset reproduction. It has made no attempt to tell you how to draw. Artwork is a specialty in itself. It requires considerable training and practice.

But whether you are an artist or not, you can clip artwork from various Navy publications. You can use them in their original form, or you can modify them slightly to serve your needs. (See fig. 4-24.)


PLEASED
THOUGHTFUL
MAD
ABUSED
WORRIED
SMILE
LAUGH (DIRTY)
YOU KNOW THIS ~~ONE~~
NOW DO IT THE EASY WAY LIKE THIS...
CLIP SOME CARTOON FIGURES FROM THE COMIC STRIPS OR THE SEA CLIPPER THAT WILL SUIT YOUR PURPOSE AND COPY THEM- DRAW THE EXPRESSIONS TO FIT THE SITUATION- AND PRESTO- YOU HAVE A CARTOON TO FILL YOUR LOCAL NEEDS-
HARRY'S CHOW DOESN'T BOTHER ME- I USED TO BE A SWORD SWALLOWER-
AFTER WHAT HE'S DONE TO MY STOMACH THEY OUGHT TO GIVE ME TH' POIPLE HEART STUDDED WITH SILVER STARS!
STOP IT. FELLAS- YOU'RE BREAKING MY HEART-
TOM
DICK
HARRY
THESE FIGURES FROM THE SEA CLIPPER CARTOONS- FACES FROM ABOVE!

57.582

Figure 4-24.—How to adapt Navy illustrations to your needs.

You can also select illustrations from commercial magazines and newspapers, but you can use them only as reference materials, since they may be copyrighted. Do not paste them up and use them as copy for offset reproduction. You must never use copyrighted material without permission. All artists and layout men use the work of others as a source of inspiration, but the work they turn out is their own product; it is not a reproduction of the original.

SUMMARY

Artwork is classified as line, tone, or combination. Line drawings contain no tones or shades—only solid blacks and whites, like those found in pen-and-ink drawings. Tone work consists of copy, such as watercolor drawings and photographs, that contain graduated shading and intermediate tones. Combination art consists of both tone and line, as for example, a photograph, to which the lettering has been added.

The same camera is used for both line and tone work, but the photographing operation is slightly different. Tone work must be copied through a halftone screen, while line work is shot without the use of the screen.

Line drawings are generally prepared for one-half or one-third reduction. Lines should be clear and open so that they will not fill in when the drawing is reduced.

Shading may be introduced into line drawings by several methods. Benday shading sheets are most commonly used, but there are also special drawing papers which lend themselves to mechanical shading.

Tone drawings and photographs should be crisp and clear. Glossy prints are better than matte-finished photographs. Blurred and faded prints should not be used.

Pictures should be cropped and retouched to emphasize the most important details. They should be carefully scaled to ensure that they will fit into the space allotted to them in the layout. Clippings or photographs of clippings may be used as copy when necessary, but they do not reproduce as satisfactorily as originals.

Oversize or bleed illustrations, insets, reverse lettering and combinations of tone and line can be used to inject special interest into a job.

When line drawings are to be printed in color, a simple black-and-white drawing will be sufficient if the colors do not overlap. If the colors are to overlap, the part of the drawing that is to go in the second color should be prepared on an acetate overlay attached to the key drawing. A separate overlay is used for each additional color.

As a rule, the artist does not attempt to separate the colors when he prepares tone copy for color reproduction. He simply furnishes full-color photographs or drawings and leaves the job of separation up to the cameraman.

It is a good idea to assemble work and paste it up into pages or into the largest possible units before submitting it to the cameraman. All pieces of same-size line copy can be pasted together on a layout sheet, but line copy that requires enlargement or reduction and tone copy must be submitted separately.

CHAPTER 5

PHOTOGRAPHIC EQUIPMENT

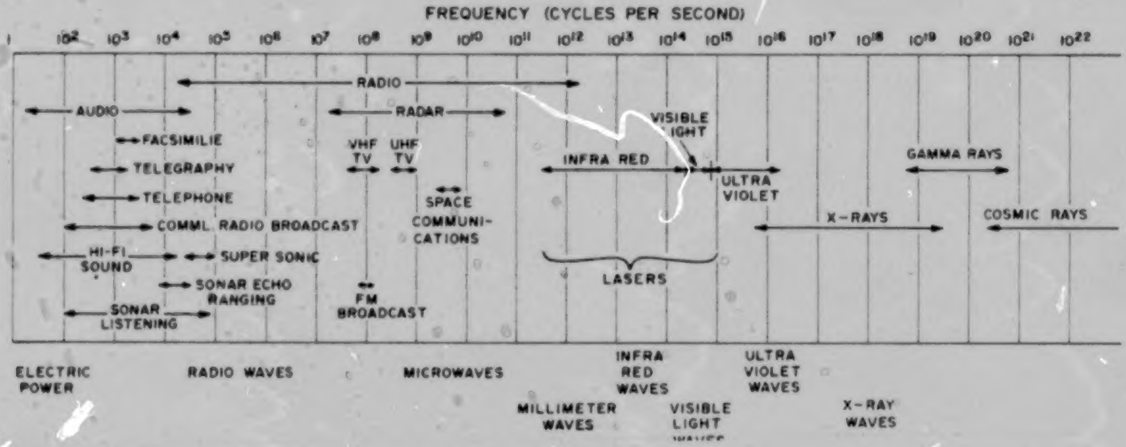
LIGHT

The sun, light bulbs, fire, and so on are said to be luminous because they generate light. You see nonluminous objects because they reflect light from luminous sources.

A large volume of light is called a beam, a narrow cylinder of light is called a pencil, and the smallest portion of light is known as a ray. (Actually there is no such thing as a single ray of light, but for the sake of clarity and convenience in describing the movement of light, a straight line is drawn to show the direction of light travel and this line is known as a ray.)

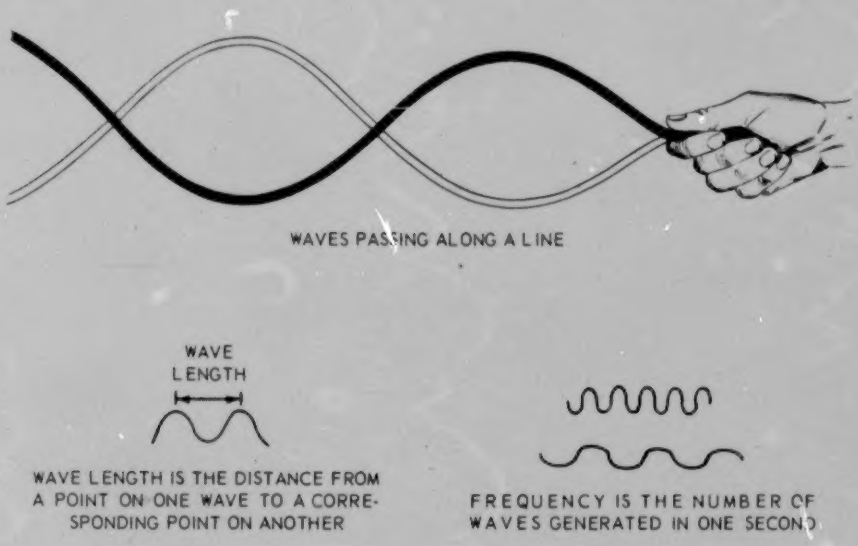
Light travels through the air at a speed of 186,000 miles per second in the form of electro-magnetic vibrations or waves. As you can see in figure 5-1, light waves, gamma rays, X-rays, radio waves, and electric (power) waves are all a part of the electromagnetic spectrum. All these waves of magnetic energy are the same; they vary only in frequency and wave length.

Wave length and frequency go hand in hand. Wave length is the distance from a point on one wave to a corresponding point on the next wave. Waves vary in length according to the type of wave, from less than a millionth of an inch to several thousand miles. Frequency is the number of waves generated in one second. (See fig. 5-2.) As waves become shorter, they increase in rapidity or frequency, and as they lengthen, their frequency is reduced. In other words, short waves have a high frequency and long waves have a low frequency. The frequency of visible light waves, for example, is millions of times greater than that of radio waves.


FREQUENCY (CYCLES PER SECOND)
1
10^2
10^3
10^4
10^5
10^6
10^7
10^8
10^9
10^{10}
10^{11}
10^{12}
10^{13}
10^{14}
10^{15}
10^{16}
10^{17}
10^{18}
10^{19}
10^{20}
10^{21}
10^{22}
RADIO
AUDIO
RADAR
FACSIMILIE
VHF TV
UHF TV
VISIBLE LIGHT
TELEGRAPHY
INFRA RED
ULTRA VIOLET
GAMMA RAYS
TELEPHONE
SPACE COMMUNI-CATIONS
COMML. RADIO BROADCAST
X-RAYS
COSMIC RAYS
HI-FI SOUND
SUPER SONIC
LASERS
SONAR ECHO RANGING
FM BROADCAST
SONAR LISTENING
ELECTRIC POWER
RADIO WAVES
MICROWAVES
INFRA RED WAVES
ULTRA VIOLET WAVES
MILLIMETER WAVES
VISIBLE LIGHT
X-RAY WAVES

113.107(57B)

Figure 5-1.—The magnetic spectrum. Light waves and radio waves are the same kind of energy; however, they vary in frequency and wave length.


WAVES PASSING ALONG A LINE
WAVE LENGTH
WAVE LENGTH IS THE DISTANCE FROM A POINT ON ONE WAVE TO A CORRESPONDING POINT ON ANOTHER
FREQUENCY IS THE NUMBER OF WAVES GENERATED IN ONE SECOND

57.584

Figure 5-2.—If you tie a piece of string to an object and then shake the string, a wave will travel from your hand down the length of the string. You might compare this wave with that produced by a luminous light source, such as a light bulb, which acts as an oscillator, creating waves of light. The wave motion of the string, however, does not represent the true motion of light because light waves move in all possible directions. You could get a clearer picture of light travel if you had a number of parallel strings each shaken in a different direction.

Comparison of Sound Waves and Light Waves

Sound waves are not a part of the electromagnetic spectrum. They differ from light waves in that they consist of a physical compression of the air, while light waves are an electromagnetic vibration. However, the two have certain properties in common, which make it possible to compare them. Figure 5-3 shows what happens when you strike a tuning fork. Notice how the air is compressed and how the sound travels in circles or waves as it moves away from the tuning fork. As the waves travel away from the source, they spread and become weaker, until finally the sound becomes inaudible.

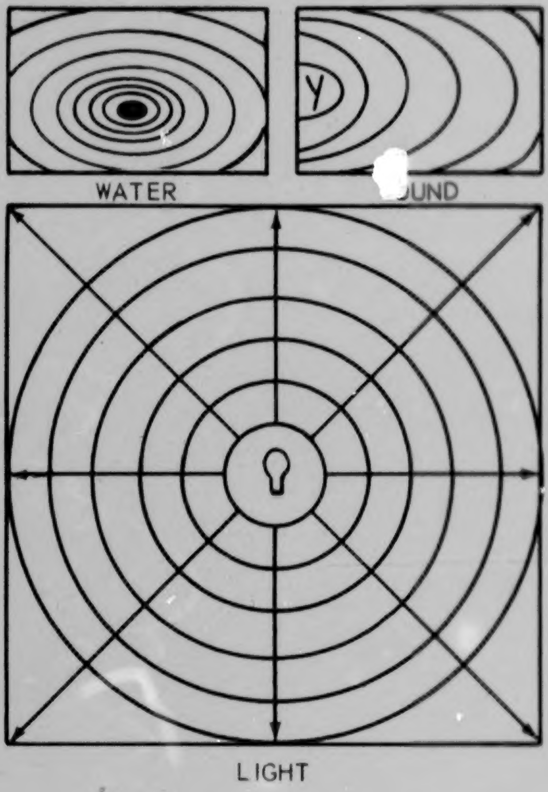
Light waves act in much the same manner. They are always stronger near the source because the rays are closer together at this point. As the waves move away from the source, the rays fan out or spread and the waves become weaker.

How We See Color

Your ear cannot detect extremely long sound waves, but as the waves become shorter, they increase in frequency and become audible—first as a low rumble or bass sound; and finally, as the frequency increases, as a treble sound or a screech. If the sound waves become too short, their frequency will become so high that the ear cannot detect them.

The eye records visible light waves just as your ear records tones. The longest waves (lowest frequencies) that the eye can see are those which produce the sensation of red. There are longer ones, called infrared, but they cannot be seen. The shortest waves that you can see are the violet. Ultraviolet waves are too short and their frequency is too high to be detected by the human eye.

When you listen to music, you hear not one, but a combination of sound waves of varying frequencies. You also see light as a combination



57.585
Figure 5-3.—If you drop a pebble in a pool of still water, you will create a series of ever-expanding waves. Sound and light also spread from their source in circular waves, but moving in all directions. The light rays used in illustrations are radii from the light source. They show the direction of light travel. Each line represents an infinite number of rays radiating in all directions from the source, but for practical purposes, each line is referred to as a light ray.

of wave lengths and frequencies. If all the optical wave lengths are combined, your eye receives the sensation of white. But a colored light will result if one of the wave lengths predominates the others.

Sound waves will pass through a wire grating or they may be transmitted through an elastic substance, such as water. Other objects, such as drapes or the tiles used for soundproofing, absorb sound. If a sound wave strikes an object which it cannot penetrate, it is bounced back or reflected. An echo is a common example of reflected sound.

Light waves may also be transmitted, absorbed, or reflected. If an object reflects all the wave lengths equally, it will look white; but if it absorbs some of the wave lengths, it will appear to be colored. A red object, for example, appears red because it reflects red light waves and absorbs the light waves of all the other colors. However, if you look at a red object under a mercury vapor light, it will appear black, because the mercury vapor light has no red in its composition for the red object to reflect. In other words, a colored object always reflects the light waves of its own color, and it appears black (colorless) if it absorbs all the colors or if the light striking it does not include the wave lengths of its particular color.

You see through transparent substances, such as glass and water, because they allow light to pass through them freely. Other substances, such as frosted glass and waxed paper, allow light to pass through, but you cannot see through them clearly, so they are said to be translucent. Still other substances, such as wood and concrete, are said to be opaque because they do not allow any light to pass through. When light passes through a substance, such as glass, which is denser than air, its speed is reduced. If the light rays strike the substance at a 90° angle, they will pass through without bending. But if they strike at any other angle, the change in speed will cause them to bend. This is known as refraction. You will learn more about it in the discussion of lenses later in this chapter. (See fig. 5-9.)

Reflection

As you have just seen, light rays which are not absorbed or transmitted by an object are thrown back or reflected. If a beam of light strikes a smooth surface, such as a mirror, at a 90° angle, it will be reflected at a 90° angle; if it strikes the surface at a 45° angle, it will reflect at a 45° angle and so on. This is known as regular reflection, and the reflected light is called specular light, because the rays are travelling in only one direction. But when a beam of light strikes a rough, uneven surface, the rays may be reflected or thrown back in several different directions. This is known as diffuse reflection, and the reflected light is called diffused light.

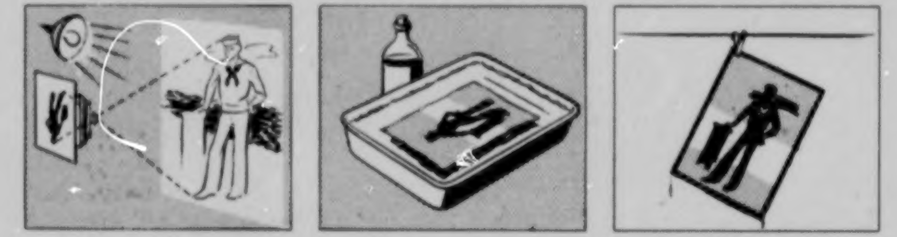
Most surfaces reflect both types of light. Smooth surfaces reflect more specular light and rough surfaces reflect more diffused light. Since diffused light is more common than specular light, it is of the greatest value in photography. Figure 5-4 shows how light rays reflected from an object pass into a camera to form an image.

BASIC PRINCIPLE OF PHOTOGRAPHY

Perhaps you have noticed how certain colors fade or bleach when they are exposed to sunlight. The radiant energy of the light sets up a chemical action wherever it strikes the dyes causing them to change color. Photographers use this "actinic" action of light to produce images on film coated with light-sensitive salts.

To produce a photographic image it is necessary to have a light source, a means of focusing the reflected light, a light-sensitive film or plate, and a means of making the image visible and permanent. Daylight may be used for taking pictures outside, but artificial light is generally required for indoor work.

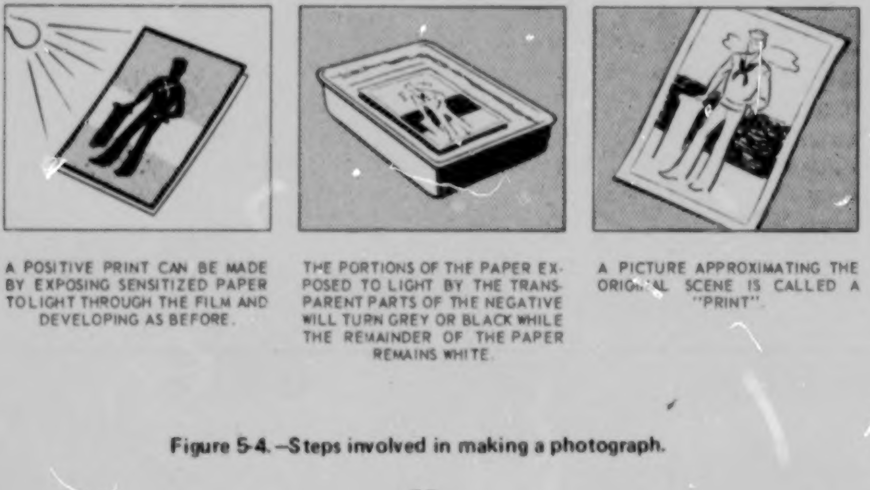
The camera is used for focusing the reflected light. It is simply a box from which all light is excluded except that passing through a small opening at the front. Cameras are equipped with various devices for controlling the light rays as they enter this opening. When you press the button on an ordinary camera, a mechanical blade or curtain, called the shutter, opens and closes automatically. During the fraction of a



LIGHT IS REFLECTED FROM THE SUBJECT INTO THE CAMERA AGAINST THE FILM.

THE PORTION OF THE SENSITIZED EMULSION AFFECTED BY LIGHT, TURNS DARK WHEN DEVELOPED IN THE PROPER CHEMICALS.

THE DEVELOPED FILM IS CALLED A NEGATIVE BECAUSE THE LIGHT IS REGISTERED ON IT IN REVERSE—BLACKS ARE WHITE AND VICE VERSA.



A POSITIVE PRINT CAN BE MADE BY EXPOSING SENSITIZED PAPER TO LIGHT THROUGH THE FILM AND DEVELOPING AS BEFORE.

THE PORTIONS OF THE PAPER EXPOSED TO LIGHT BY THE TRANSPARENT PARTS OF THE NEGATIVE WILL TURN GREY OR BLACK WHILE THE REMAINDER OF THE PAPER REMAINS WHITE.

A PICTURE APPROXIMATING THE ORIGINAL SCENE IS CALLED A "PRINT".

57.45

Figure 5-4.—Steps involved in making a photograph.

second that the shutter is open the light reflected from the subject passes into the camera through a piece of optical glass called the lens. The lens focuses or projects the light rays onto the wall at the back of the camera much the same as a motion picture projector projects an image onto a screen in a darkened theater.

You can capture this light image by attaching a piece of film to the back of the camera. Film, as you may already know is simply a sheet of transparent acetate coated with a layer of gelatin in which are suspended millions of tiny particles of silver salts. When film is exposed in the camera, these silver particles are ionized or broken up wherever they are struck by the light. Shadows and dark areas reflect little light; therefore little change occurs in the film emulsion in areas where the subject is dark. But there is a good deal of change in areas where the emulsion is struck by strong light reflections.

These changes are not visible to the eye as a rule, but when the film is placed in a chemical "developing" solution, the exposed particles change to black, metallic silver. In areas where the film was struck by strong light reflections, the silver deposit will be very dense or black; in areas where the light reflections were weaker, the silver deposit will be thinner and have a gray appearance on the film. Areas of the film which correspond to the dark or shadow areas of the original subject may have received no light reflection at all; consequently the silver salts in these areas are not exposed and will not turn dark in the developer unless development is continued too long.

However these unexposed salts will still be affected if they are exposed to light. Therefore, the film must be "fixed" in another chemical solution called "hypo". This solution dissolves the unexposed salts and leaves clear, transparent areas on the film. The film is then washed and dried. The developed film is called a negative because the light has registered on it in reverse. That is, it is dark where the original subject was light and transparent where the original subject was dark.

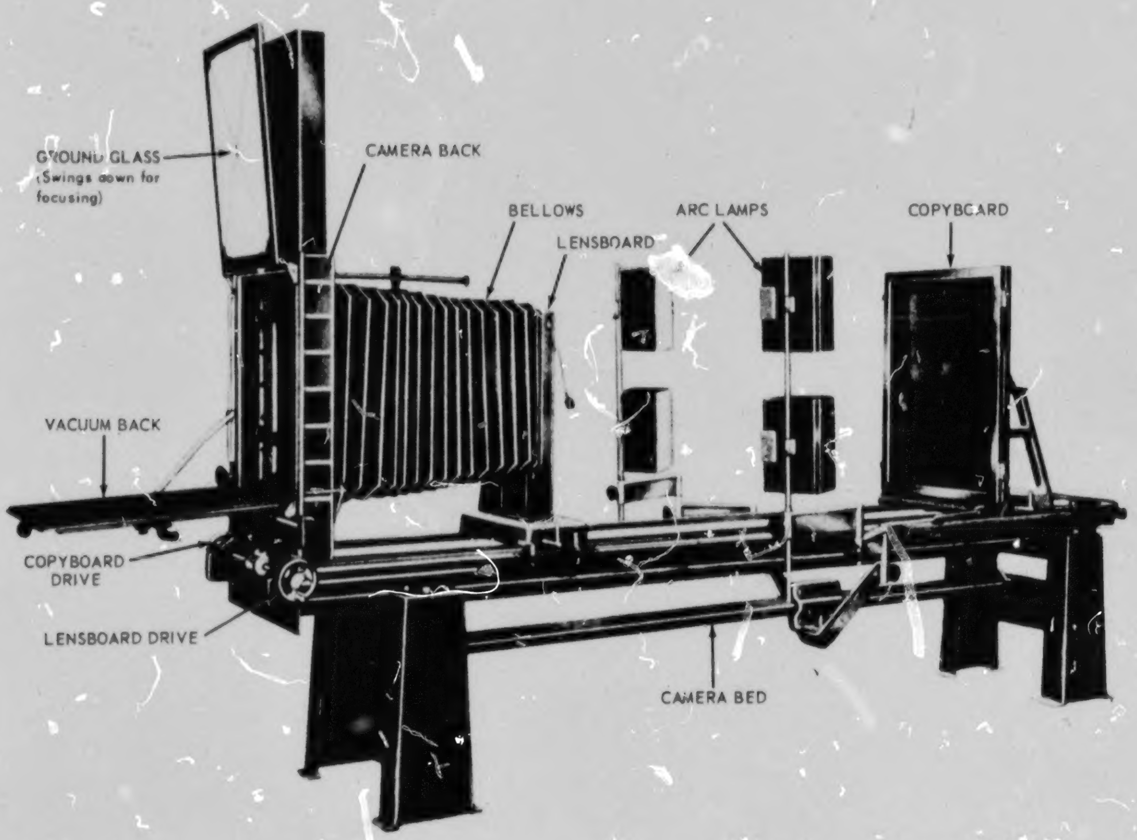
You can make a positive print by exposing a piece of sensitized paper to the light through the negative. The negative will act as a stencil, holding back part of the light and passing part of it on to the light-sensitive coating on the paper. After the exposure, the print is processed in much the same manner as the negative. This time you will have a duplicate of the original subject with dark and light areas corresponding to those of the original. (See fig. 5-4.) You can also use the negative for making a positive copy on film or for making an offset press plate. You will learn more about film positives and press plates later in this book.

THE PROCESS CAMERA

The camera used in graphic arts photography is called a process camera. Although larger than the type of camera you use to take snapshots, it is similar in principle. Since the process camera is built for copying, it is equipped with a copyboard and has other features not associated with the average camera. There are two types of process cameras: horizontal and vertical. The horizontal process camera is the type you will see most often in the Navy and in commercial shops. However, in recent years the Navy has been outfitting the print shops aboard new ships with the vertical process cameras. There is a considerable saving of floor space when the vertical cameras are installed aboard ship.

Unless you are stationed aboard one of the newer ships, the horizontal process camera shown in figure 5-5 is the type you will operate. This camera is known as a darkroom camera because the back of it is built into the darkroom wall. (The term darkroom refers to the room where the film is developed.) Because the back of the camera extends into the darkroom, and the front is housed in a separate room, the cameraman can load the film, focus the camera, make the exposure, and develop the film without leaving the darkroom. Of course, it is still necessary for him or a helper to go outside to place copy in the copyboard before the exposure is made.

There is another type of horizontal camera which is housed entirely in one room. It is called a gallery camera. Since there aren't many gallery cameras in use in the Navy and the operating instructions are similar to the horizontal or vertical models you will operate, the gallery camera is not discussed further here.



57.48X

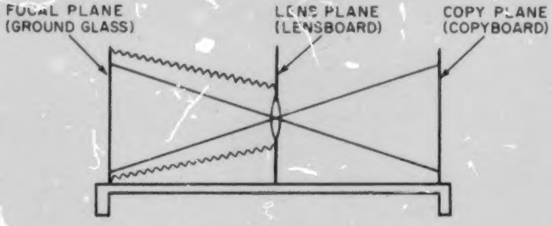
Figure 5-5.—Darkroom process camera. The camera back fits into an opening in the darkroom wall. All units to the left of the back are housed in the darkroom; all units to the right are housed in a separate room.

As you can see in figure 5-6, all process cameras have three planes or surfaces:

1. The copy plane (copyboard to which the copy is attached).
2. The lens plane (lensboard or front of the camera into which the lens is fitted.
3. The focal plane (back of the camera which consists of a film-holding device and a ground (frosted) glass viewing surface. The image projected through the lens is focused onto this surface.

These three units are generally mounted on a spring-suspended bed which is attached to the floor; however, on large cameras, they may be suspended from overhead tracks. Springs, rubber, and similar materials are used to absorb shock and keep the units from jarring or moving while the film is being exposed.

Handwheels or cranks are usually provided at the back of the camera to enable the cameraman to move two of these planes forward or backward along the tracks when he is focusing (setting the camera so that the light rays will come together to produce a sharp image of the proper size on the ground glass). Generally, the back of the camera is stationary and the lensboard and copyboard can be moved for focusing. If the position of the copyboard is fixed, the lensboard and back of the camera are



57.47

Figure 5-6.–The process camera consists basically of three parallel planes.

movable. On some cameras, it is possible to move all three units.

The positions of the copyboard and lensboard affect the size as well as the sharpness of the image. When the camera is set so that the ground glass and the copyboard are both the same distance from the lens, it is said to be set for a "same-size" shot because the image on the ground glass is the same size as the image on the original copy. If the lensboard is moved closer to the back of the camera, the image is reduced, and if the lensboard is moved farther away, the image is enlarged.

Most process cameras are equipped with scales that show the cameraman where to set the copyboard and lensboard for the amount of enlargement or reduction required. If these scales are not available, or if he is using a lens that does not match the calibrations on the scales, it may be necessary for the cameraman to focus the camera by watching the image on the ground glass as he moves the copyboard and lensboard. In this case, he must measure the image with a ruler to see that it is the proper size, and he must examine it with a magnifying glass to see that the fine lines are sharply focused before he makes the exposure. This is known as visual focusing.

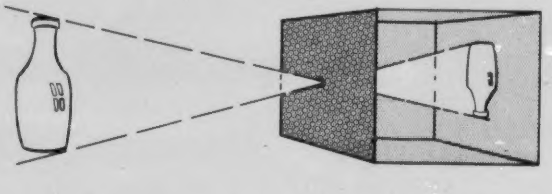
The exposure is not made through the ground glass. Before he makes the exposure, the cameraman swings the ground glass out of the way and then moves the film holding device into its place. On darkroom cameras, the film holding device usually consists of a grooved metal door, called a vacuum back which holds the film perfectly flat by suction. Some cameras are not equipped with vacuum backs. On these, the film holder consists of a door which is covered with a sticky substance called "stayflat."

THE LENS

The lens is the camera's eye. In order to understand how it works, study the pinhole camera, shown in figure 5-7. This is the simplest form of camera. In fact, it is so simple that you can make one yourself by attaching a piece of film to one end of a cardboard box, punching a hole in the opposite end, and then sealing the box so that all light is excluded except that entering through the pinhole. Although an extremely long exposure is required, you can use the pinhole camera for taking pictures of objects where no motion is involved.

Image Formation

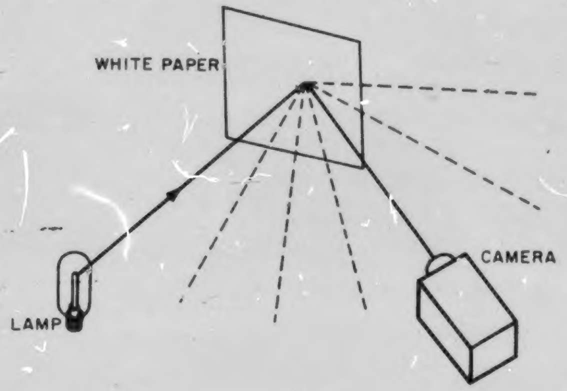
If you will study the diagram shown in figure 5-7, you will see how the pinhole camera forms its image. Notice how the light rays pass through the pinhole and onto the film at the back of the box. Notice, too that the image formed on the film is upside down (reversed). This is due to the fact that the light rays travel in straight lines and they cross each other at the pinpoint opening.



57.50

Figure 5-7.–Image formation in a pinhole camera.

As you can see in figure 5-8, each point on the copy reflects light rays in all directions, but since the pinhole is so small, only one ray from each point on the copy can pass through it to reach the film. If you think of the copy as consisting of millions of these tiny points, each reflecting a light ray to a corresponding point on the film, you can understand better how these points combine to form an image or likeness of the original copy on the film.



57.51

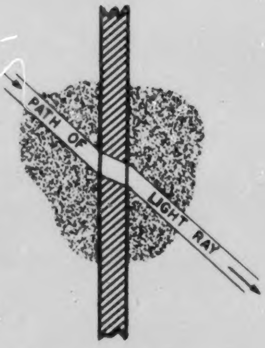
Figure 5-8.—How light rays are reflected from a point on the copy.

Unfortunately the pinhole camera has little practical value because of the extreme length of time required to expose the film. Of course, you can cut down exposure time by making a larger pinhole. The larger opening will let in more light, but it will also cause the image to be blurred, because it will allow more than one ray from each point on the copy to enter the camera, and this will cause the rays to overlap on the film.

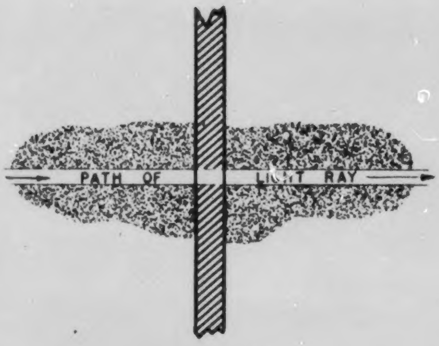
Image Formation with a Lens

When you use a larger opening, you must have some means of controlling the light rays—and that is where the lens comes in. The lens is a piece of optical glass, scientifically ground to catch the light rays reflected from each point on the copy and bend them so they will come together again at a point inside the camera.

You have already seen that light rays travel through the air at approximately 186,000 miles a second. But when they strike the lens, the resistance of the glass changes their speed and causes the oblique rays to bend, as shown in figure 5-9.



LIGHT RAYS STRIKING THE LENS OBLIQUELY (AT AN ANGLE) ARE BENT BY THE LENS.



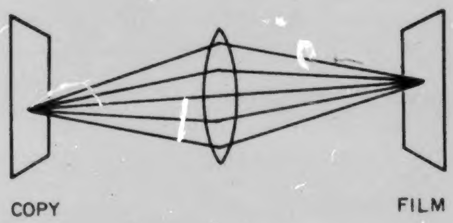
RAYS STRIKING THE LENS PERPENDICULARLY WILL NOT BE BENT ALTHOUGH THEY WILL BE SLOWED DOWN CONSIDERABLY.

57.52

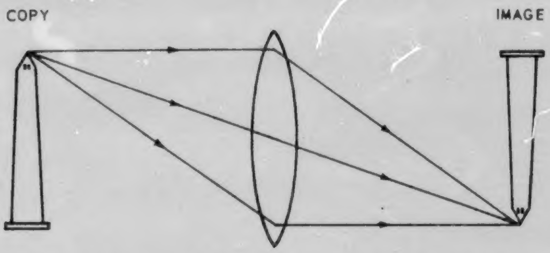
Figure 5-9.—Refraction of light. It is upon this principle that the design of photographic lenses is based. The extent of refraction depends on the slant at which the light strikes the lens, on the composition and color of the light, and on the difference in optical density between the lens and the air.

As you can see in figure 5-10, the lens is capable of receiving numerous light rays from a single point and bending them so that they will all converge or come together again to form a similar point behind the lens. The diagram in figure 5-11 shows how this principle is applied to forming an image on the film.

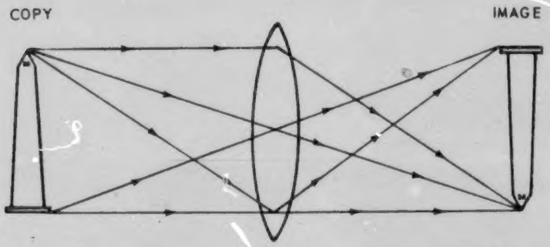
If you will study the diagram for a minute, you will see how a group of rays emanating from a point at the top of the subject pass through the lens and converge behind it to form a single



57.53
Figure 5-10.–The lens can capture any number of rays emanating from a single point on the copy and bend them so that they will come together again to form a similar point inside the camera.



HOW LIGHT RAYS FROM ONE POINT ON THE COPY CONVERGE TO FORM A SIMILAR POINT ON THE FILM.



HOW LIGHT RAYS FROM TWO POINTS ON THE COPY CONVERGE TO FORM TWO SIMILAR POINTS ON THE FILM. THE OVERALL IMAGE IS FORMED ON THE FILM BY SETS OF LIGHT RAYS, SUCH AS THESE, REFLECTED FROM THE MILLIONS OF TINY POINTS THAT COMBINE TO MAKE UP THE ORIGINAL COPY.

57.54
Figure 5-11.–Image formation by a lens.

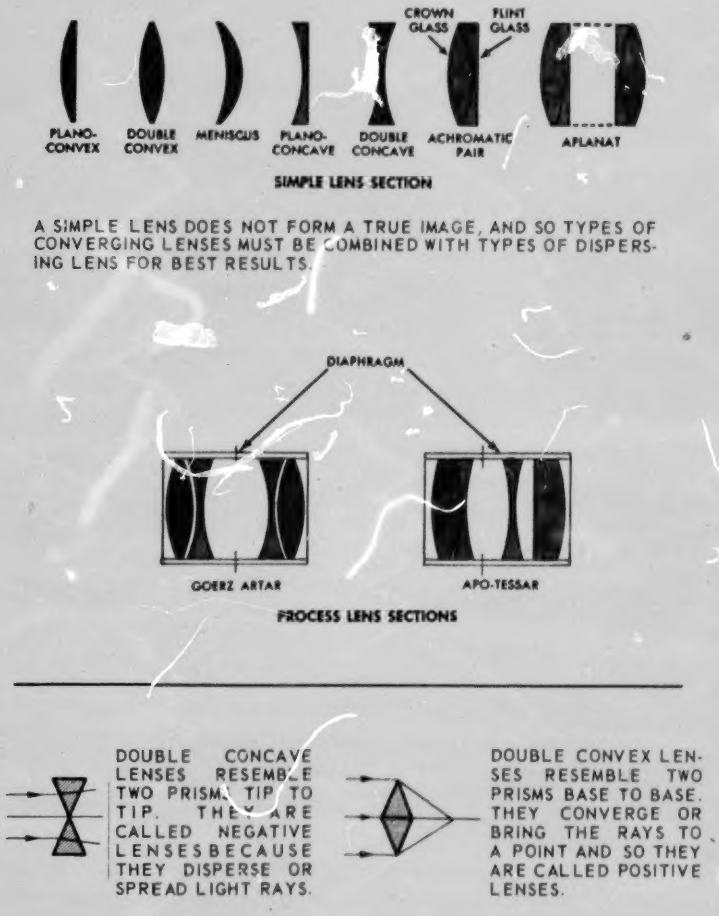
point on the film, and how multiple rays emanating from a point at the base of the subject pass through the lens and converge to form another point on the film. The diagram is simplified for the sake of clarity. Actually, the lens can capture any number of rays emanating from each point on the copy and bring them together again to form similar points inside the camera. As in the case of the pinhole camera, the overall image or likeness is formed on the film by sets of rays reflected from the millions of tiny points that combine to make up the original copy.

A simple lens, like the one shown in the diagram cannot form a sharp image however, because the light rays passing through its edges are bent more than those passing near the center. Therefore some of the rays coming from a particular point on the copy do not meet at the same point on the film, and this causes a slight fuzziness. Lens manufacturers correct this fault by combining lenses that spread the light (negative or divergent lenses) with lenses that cause the light rays to converge or come to a point (positive or convergent lenses). (See fig. 5-12.) Two or more of these individual lenses (called elements) are fitted together in a metal tube known as the lens barrel. The entire assembly is then referred to as the lens. (See fig. 5-13.)

Focusing

You have just seen how the light rays from the copy pass through the lens to form an image at a point inside the camera. If you will look at figure 5-14 for a moment, you will see that if the light rays come from an object near the camera, they focus or come to a point a considerable distance behind the lens. If the object is moved farther away from the camera, the light rays come to focus closer to the lens. If the object is moved far enough away from the camera (approximately 600 feet) the lens is said to be focused at an infinite distance or infinity and the image will form at the closest possible point behind the lens.

From this you can see that when you focus a lens, only those objects that are a specific distance from it will be in absolute focus. Objects farther away or closer to the camera will be slightly fuzzy, although the distortion may be so slight that the eye will not notice it. The ability of the lens to produce (at one setting) a reasonably sharp image of several objects at varying distances from the camera is known as


CROWN GLASS
FLINT GLASS
PLANO-CONVEX
DOUBLE CONVEX
MENISCUS
PLANO-CONCAVE
DOUBLE CONCAVE
ACHROMATIC PAIR
APLANAT
SIMPLE LENS SECTION
DIAPHRAGM
GOERZ ARTAR
APO-TESSAR
PROCESS LENS SECTIONS

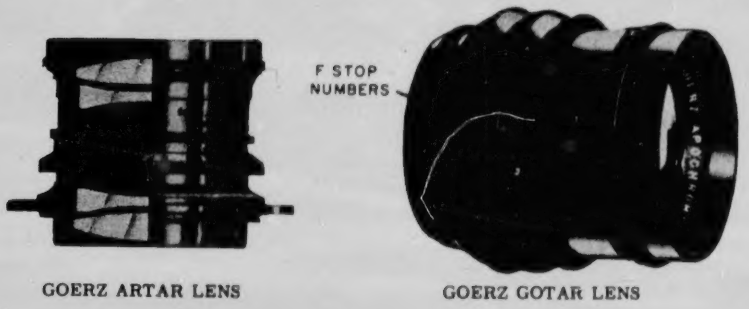
A SIMPLE LENS DOES NOT FORM A TRUE IMAGE, AND SO TYPES OF CONVERGING LENSES MUST BE COMBINED WITH TYPES OF DISPERSING LENS FOR BEST RESULTS.

DOUBLE CONCAVE LENSES RESEMBLE TWO PRISMS TIP TO TIP. THEY ARE CALLED NEGATIVE LENSES BECAUSE THEY DISPERSE OR SPREAD LIGHT RAYS.

DOUBLE CONVEX LENSES RESEMBLE TWO PRISMS BASE TO BASE. THEY CONVERGE OR BRING THE RAYS TO A POINT AND SO THEY ARE CALLED POSITIVE LENSES.

57.55

Figure 5-12.—Types of lenses.

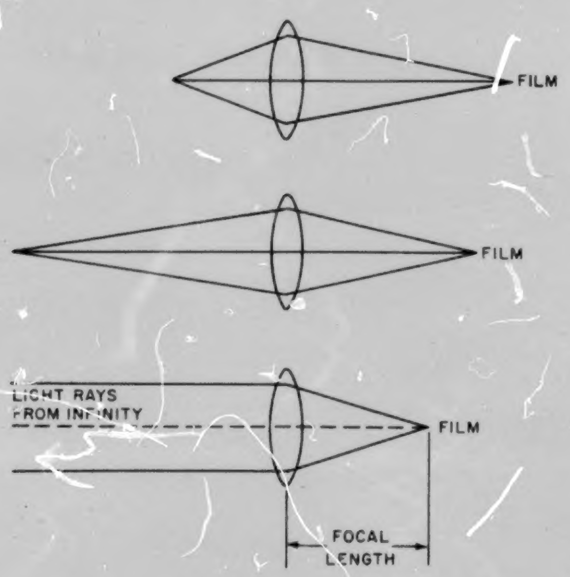

F STOP NUMBERS

GOERZ ARTAR LENS

GOERZ GOTAR LENS

57.56X

Figure 5-13.—Process camera lenses.

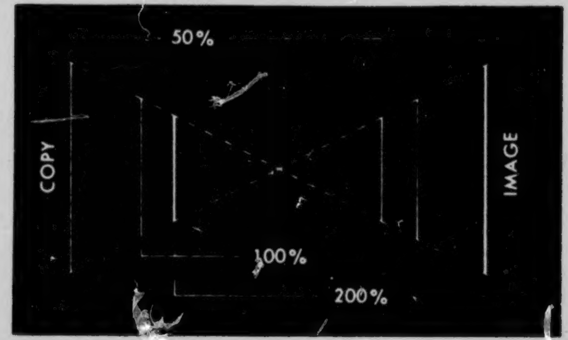


57.57

Figure 5-14.—Light rays coming from a distant object come to focus at a point closer behind the lens than those coming from a near object. When the lens is focused on an object 600 or more feet away, it is said to be focused at infinity, and the image will form at the closest possible point behind the lens. The distance from this point to the center of the lens is known as the focal length of the lens.

depth of focus. Depth of focus (also called depth of field) is not as important in process camera work as it is in other types of photography, because you are shooting flat copy, all portions of which are the same distance from the film. But it does allow you a slight tolerance when you are setting up the camera, particularly when you are focusing for reductions.

Of course, the process cameraman is concerned with size as well as sharpness of the image. You have already seen that when the copyboard and ground glass are focused at the same distance from the lens, the image formed is the same size as the original copy. If the cameraman wishes to enlarge the image, he moves the lensboard away from the ground glass and then moves the copyboard into focus. If he wants to reduce the image, he moves the lensboard closer to the ground glass and then adjusts the copyboard. (See fig. 5-15.)



57.58X

Figure 5-15.—As the lens is moved away from the film, the image area grows larger and the area of copy that the lens can cover is reduced. As the lens is moved toward the film, the image area is reduced and the lens can cover a larger copy area.

Focal Length

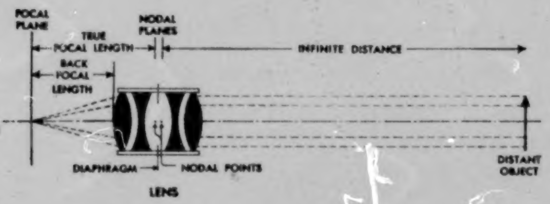
Lenses are usually classified by focal length, speed, and degree of correction for distortion and other aberrations. Focal length is simply the distance from the optical center of the lens to the point behind the lens where the sharpest image is produced when the camera is focused on an object at infinity. (See fig. 5-16.)

There are three factors which control focal length: (1) the curvature of the lens surfaces, (2) the kinds of glass used for the lens, and (3) the separation of the elements of the lens.

There are many different methods of determining focal length, but we are not concerned with them here, because focal lengths are determined by the manufacturers and stamped on the lens barrel.

If you do not know the focal length of the lens you are using, however, you can determine it experimentally by setting the camera for a same-size shot and then measuring the distance from the copyboard to the middle of the lens barrel. One half of this distance will be equal to the focal length of the lens. If there are 32 inches between the copy and the optical center of the lens, you will know that your camera is equipped with a 16-inch lens.

In process camera work, the size of the image depends on the distance from the copy to the



57.59
Figure 5-16.—Process lens characteristics. You can use the rated length of your lens for calculating purposes. For approximate distances, the middle of the lens barrel can be taken as a point for all measurements, although in exact calibrations, two theoretical points within the lens, known as nodal points must be used.

lens, the distance from the lens to the film, and the focal length of the lens.

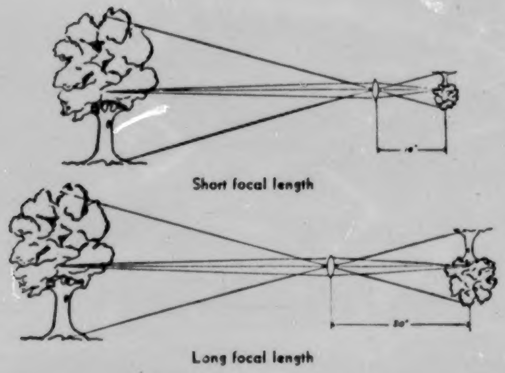
As the lens is moved away from the film, the image area on the film grows larger and the area of copy that the lens can cover decreases. The opposite occurs when the lens is moved toward the film. Lenses with long focal lengths have greater covering power and produce larger images than those with short focal lengths. For example, if a 12-inch lens will produce an image 4 inches wide when the copyboard is a certain distance from the lens, a 24-inch lens will produce an image 8 inches wide using the same distance from copy to lens. (See fig. 5-17.) In other words, lenses with long focal lengths include less copy area, but any object in that area will appear larger on the film than it would if photographed with a lens having a shorter focal length.

Law of Inverse Squares

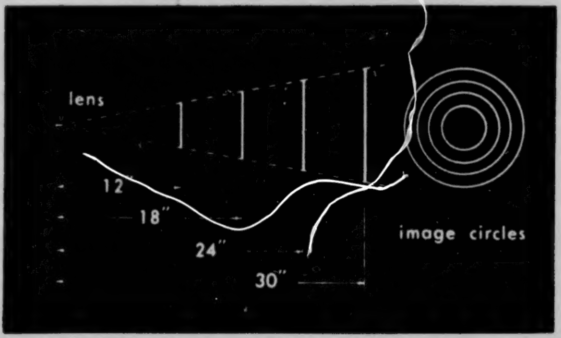
Lenses with long focal lengths can produce larger images than those with short focal lengths because they are capable of projecting a sharp image farther into the camera. (See fig. 5-18.) When the lens is moved away from the film, the light is spread over a greater area and the image is enlarged.

But spreading the light weakens its intensity, and the more it is spread, the weaker it becomes. Look at figure 5-19 for a moment. If it takes 15 seconds to make a proper exposure when the distance between the lens and film is 1 foot, it will take 60 seconds (four times as long) to get the same exposure if the distance is increased to 2 feet. This is due to the fact that when the distance between the film and lens is doubled, the light is spread over four times its former area, and it is so weakened that it will take four times as long to get the proper exposure.

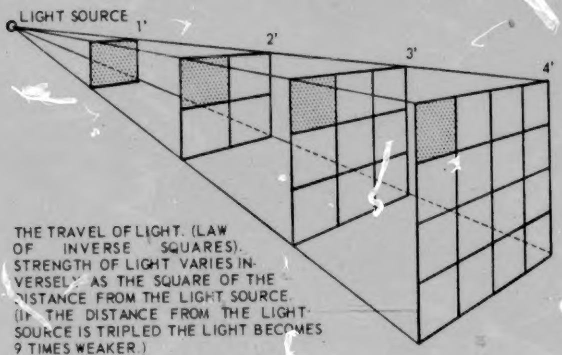
Tripling the distance will enlarge the image nine times and an exposure nine times longer than the original will be required. This loss of strength as the light travels through the air can



57.60
Figure 5-17.—The size of the image in relation to the focal length of the lens.



57.61X
Figure 5-18.—Lenses with long focal lengths have greater covering power than the same type of lenses with short focal lengths.


LIGHT SOURCE
1'
2'
3'
4'
THE TRAVEL OF LIGHT. (LAW OF INVERSE SQUARES). STRENGTH OF LIGHT VARIES INVERSELY AS THE SQUARE OF THE DISTANCE FROM THE LIGHT SOURCE. (IF THE DISTANCE FROM THE LIGHT SOURCE IS TRIPLED THE LIGHT BECOMES 9 TIMES WEAKER.)

57.62

Figure 5-19.–Illumination principles.

be expressed by a mathematical rule known as the "law of inverse squares" which states that "the strength of light varies inversely as the square of the distance from the light source."

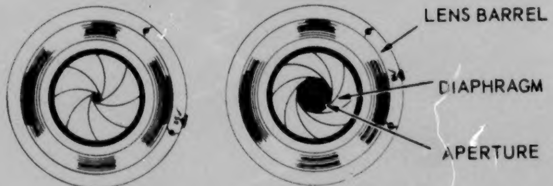
You can compensate for this loss of light strength in two ways. You can use a longer exposure, as already mentioned, or you can use a larger lens opening to let more light enter the camera in the same amount of time.

Lens Diaphragm

Each lens barrel contains a device known as the iris diaphragm. The diaphragm consists of a series of thin metal or composition blades which are so arranged as to form a circular opening in the center of the lens barrel. This opening is known as the lens aperture. By turning a collar on the outside of the lens barrel, the cameraman can adjust these blades to increase or decrease the size of the aperture and thus regulate the amount of light entering the camera. (See fig. 5-20.)

F-Numbers

You have seen in figure 5-17 that when the distance from the lens to the copy remains constant, a lens with a long focal length will project the image farther into the camera and create a larger image than one having a short focal length. Of course, the farther the image is projected, the weaker the light becomes and the exposure must be lengthened or the aperture adjusted accordingly to produce the proper exposure on the film.



40.163

Figure 5-20.–The aperture setting is made by adjusting the lens diaphragm.

To maintain the proper relation between the amount of light let into the camera and the distance it must travel once it gets inside, photographers have adopted a scale of values called f-numbers or f-stops which show the relation of the lens opening to its focal length.

The f-numbers are marked on the lens collar and are used in setting the aperture. (See fig. 5-13.) Each f-number represents a fractional part of the focal length of the lens. When the cameraman sets the collar at f/8, the diaphragm will automatically form an opening in the lens barrel that is 1/8 as wide as the focal length of the lens. If the focal length of the lens is 16 inches, the diameter of the lens opening will be 2 inches. Similarly, setting the aperture at f/16 will mean 1/16 of 16 or a 1-inch opening, and so on.

Occasionally, the cameraman will find it necessary to use a lens opening smaller than the smallest lens aperture setting. To accomplish this, he places a thin, metal blade, which has an accurately drilled hole to the proportion of the lens, in a slot in the lens barrel. The metal blade is called a Waterhouse stop. The slot is sometimes called the filter slot, because it is also used for the insertion of filters.

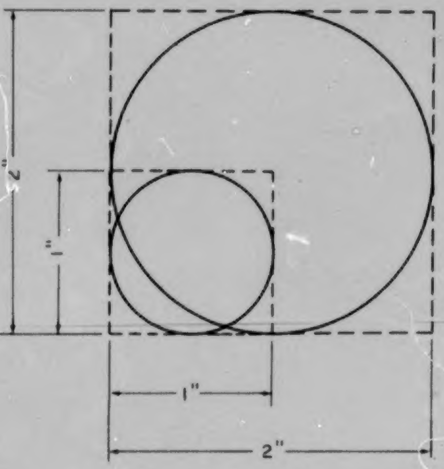
Lens Speed

The smallest f-numbers represent the largest apertures. Beginning with f/1, each succeeding major f-number is determined by multiplying by 1.4 (the square root of 2). Thus you have f/1, f/1.4, f/2*, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/45, f/64, f/90, and so on. These are known as the major f-numbers or stops. An f-number falling in between these major stops is known as an intermediate stop. All cameras do not have the full range of f-stops. The f-numbers on the high speed cameras used by sports photographers, for example, may range from f/1 through f/22, while the numbers on a process camera may begin at f/8 and run through f/90. The speed of the lens is determined by the largest f-number that can be used with it. A lens with an f/1 opening is faster than one with a maximum opening of f/8 because the f/1 opening is relatively larger and lets in more light thereby reducing exposure time.

For many years, it was believed that greater detail and sharpness was obtained from process camera lenses when they were stopped down to the smaller aperture settings. Tests have proved that the sharpest image is realized when the lens is stopped down one or two stops from the largest lens opening. For example, if the camera you are operating has a f/11 lens, the lens aperture setting should be set at f/16 or f/22 for a same-size exposure. When the aperture setting is f/45 and smaller, the tests show that there is considerable loss of detail and sharpness.

The length of an exposure depends to some extent on the lens aperture setting. Using the next larger or smaller major lens opening either halves or doubles your exposure time. For example, a 10-second exposure at f/11 will require 20 seconds at f/16 or 5 seconds at f/8. If you will study figure 5-21 for a moment, you will see that the f/16 aperture is only one-fourth as large as the f/8 opening. Therefore, it lets in only one fourth as much light and the exposure time must be increased four times to produce the same effect on the film.

The following table shows the relative exposure times required for the major lens openings.



57.63

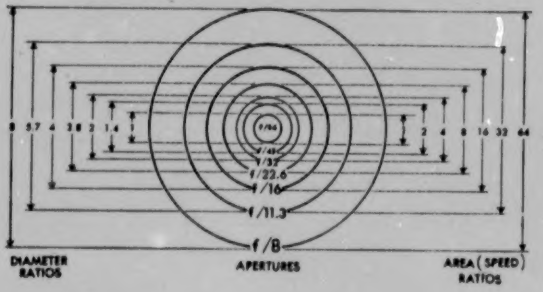
Figure 5-21.—Comparison of lens openings. An f/8 aperture on a 16-inch lens is approximately 2 inches wide and an f/16 opening is 1 inch wide. Therefore, the f/8 opening has four times the area of the f/16.

F number	8	11	16	22	32	45	64
Relative exposure time in seconds	1	2	4	8	16	32	64

Figure 5-22 illustrates the comparative areas of the lens stops.

Lens Diaphragm Control System

The basic exposure time and aperture setting for same-size (1:1) work varies with the speed of



57.64

Figure 5-22.—Comparative areas of lens stops.

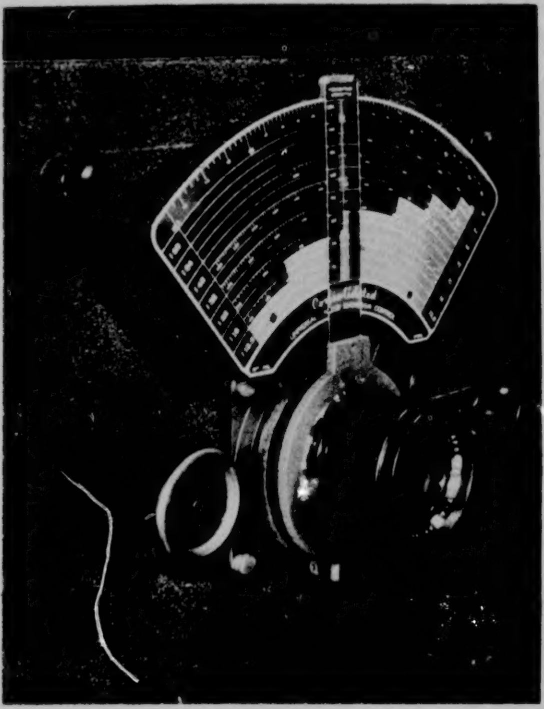
---

*In some cases the numbers are rounded off to the nearest whole number.

the film and the particular camera set-up you are using. A series of test exposures will determine the basic exposure time and aperture setting for the camera you are operating.

As you have seen earlier in this chapter, the intensity of light received by the film varies as the distance between the lens and the film is changed. A change in film-lens distance occurs when the camera extension is changed for an enlargement or reduction of the original copy. The purpose of the lens diaphragm is to open or close the lens aperture, thereby regulating the amount of light the film receives. The amount of time of the exposure remains the same regardless of the camera extension.

There are several types of diaphragm control systems, but the one shown in figure 5-23 is typical of those found on many process cameras. It consists of a pointer which is attached to the lens collar and a metal plate which is attached to the lens barrel. The plate has a series of scales—one for each major f-stop—and each scale is graduated to show percentages of enlargement or reduction. The cameraman determines the percentage of enlargement or reduction with a scaling wheel, like the one shown in figure 5-23. He then simply moves the pointer to the proper place along the selected f-stop scale. Since the pointer is attached to the lens collar, the aperture is set automatically.



57.65X

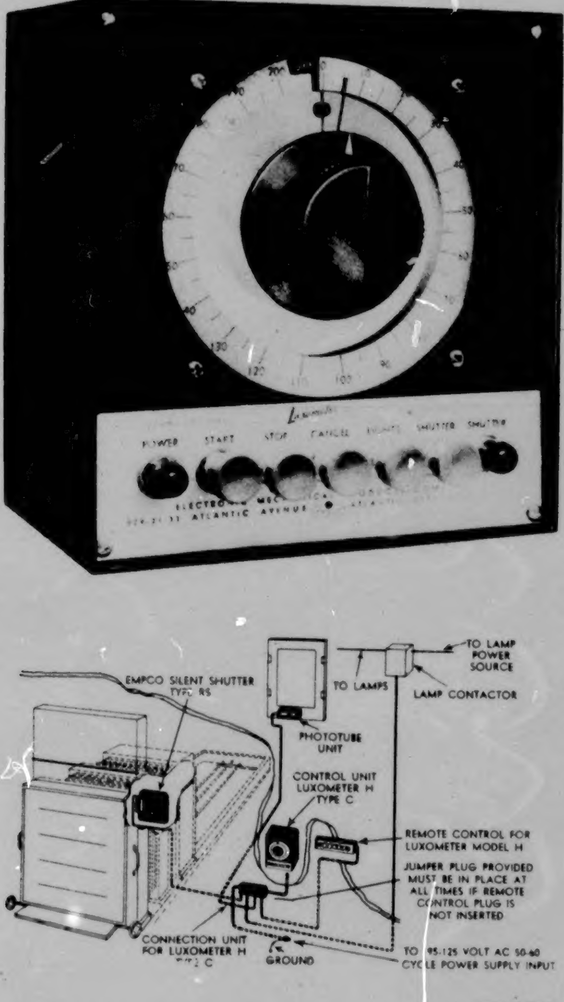
Figure 5-23.—Diaphragm control system. There is a separate scale for each major f-stop. If the cameraman is using f/22 as the basic aperture for a line shot and the copy is to be shot twice size, he would set the pointer at 200% on the f/22 scale.

Shutters

Process cameras are equipped with a shutter which opens to admit light through the lens or closes to stop the passage of light. The shutter is located behind the lens and is electrically operated. It is connected to a timer which is set for a predetermined length of time. When the starting button on the timer is pushed, the shutter and the camera lamps are simultaneously activated. When the time of the exposure has expired, the camera lamps are turned off and the shutter automatically closes.

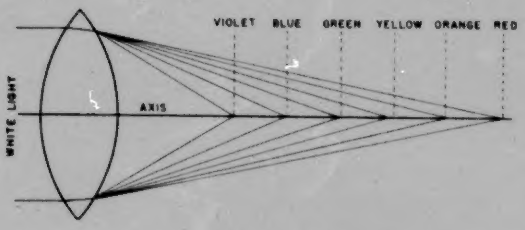
Some cameras are equipped with a light-integrating device, consisting of a photoelectric cell which is attached to the copyboard and connected to a control unit by wires. The photoelectric cell measures the amount of light falling on the copy and transmits electrical impulses to the control unit where they are registered on a timing device that automatically closes the shutter and turns off the lights to end the exposure after the required time. (See fig. 5-24.)

Some of the older process cameras are equipped with other types of shutter releases, such as an air bulb which the operator squeezes to open the shutter and squeezes again to close it. There are also process cameras that do not have shutters. On these cameras, the operator controls the length of the exposure with a light-proof cap (called the lens cap) which fits over the end of the lens barrel. He removes this cap to make the exposure, and after the required time, he replaces it to bring the exposure to an end.


POWER
START
STOP
CANCEL
SHUTTER
SHUTTER
ATLANTIC AVENUE
EMPCO SILENT SHUTTER TYPE RS
TO LAMPS
TO LAMP POWER SOURCE
LAMP CONTACTOR
PHOTOTUBE UNIT
CONTROL UNIT LUXOMETER H TYPE C
REMOTE CONTROL FOR LUXOMETER MODEL H
JUMPER PLUG PROVIDED MUST BE IN PLACE AT ALL TIMES IF REMOTE CONTROL PLUG IS NOT INSERTED
CONNECTION UNIT FOR LUXOMETER H TYPE C
GROUND
TO 95-125 VOLT AC 50-60 CYCLE POWER SUPPLY INPUT

57.69X

Figure 5-24.—Light integrating device.


VIOLET
BLUE
GREEN
YELLOW
ORANGE
RED
WHITE LIGHT
AXIS

57.67

Figure 5-25.--Convergence of colored rays from white light.

Lens Aberrations

A single lens, such as the ones shown at the top of figure 5-12, cannot form a sharp image because it cannot bend all light rays uniformly. The light rays passing through the outer edges of the lens are bent more than those passing near the center, for example, and they will not meet at the same point.

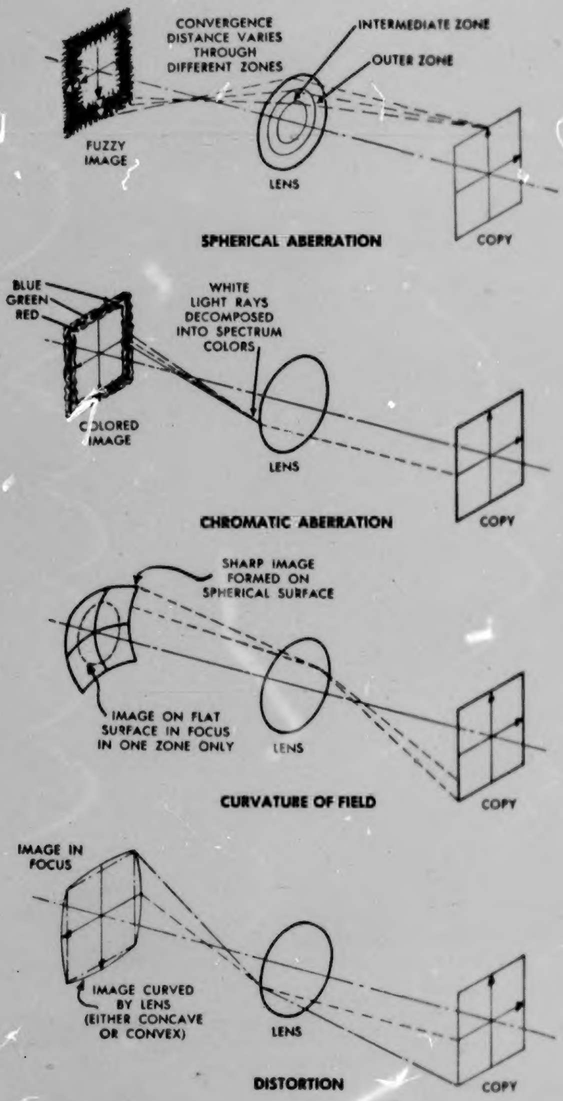
Rays of certain colors are also bent more than others. (See fig. 5-25.) If you look at printed matter through a magnifying glass, you may find colored outlines around the letters. These outlines are there because the lens does not focus all colors on the same plane. As you know, white light is composed of a series of colored waves, some of which are longer than others. Colors of the shorter wave lengths are bent the most as they pass through the lens and colors of the long wave lengths are bent the least. Since these rays do not come together at a single point, they tend to overlap and create a blurred or outlined image.

These lens defects are known as aberrations. There are several types of aberrations common to all lenses:

1. Chromatic aberration, as you have just seen, is the inability of the lens to focus all colors on the same plane. (See fig. 5-25.) You can minimize it by using a smaller lens aperture, or the manufacturer can correct it by using a combination of lenses made of different types of glass. Crown and flint glass are generally used for this purpose, and the lenses are ground so that they bend the light rays in opposite directions. One spreads the light while the other brings the rays together to a point. This combination causes the longer wave lengths to be refracted more sharply and the shorter wave lengths to have less refraction so that most chromatic aberration is cancelled out before it reaches the film. Lenses corrected to bring two of the primary colors together on the same plane are known as achromatic. Lenses corrected to focus all the primary colors are called apochromatic lenses.

2. Spherical aberration occurs when the light rays passing through the outer edges of the lens

focus on a different plane from those passing through the center. This causes the edge of the image to be out of focus when the center is sharp and vice versa. (See fig. 5-26.) The manufacturer corrects this condition by combining positive and negative lenses, by calculating suitable curvatures for each lens element, and by varying the thickness and separation of the elements. Stopping down the lens with the iris diaphragm will also reduce spherical aberration.


CONVERGENCE DISTANCE VARIES THROUGH DIFFERENT ZONES
INTERMEDIATE ZONE
OUTER ZONE
FUZZY IMAGE
LENS
COPY
SPHERICAL ABERRATION
BLUE
GREEN
RED
WHITE LIGHT RAYS DECOMPOSED INTO SPECTRUM COLORS
COLORED IMAGE
LENS
COPY
CHROMATIC ABERRATION
SHARP IMAGE FORMED ON SPHERICAL SURFACE
IMAGE ON FLAT SURFACE IN FOCUS IN ONE ZONE ONLY
LENS
COPY
CURVATURE OF FIELD
IMAGE IN FOCUS
IMAGE CURVED BY LENS (EITHER CONCAVE OR CONVEX)
LENS
COPY
DISTORTION

57.66

Figure 5-26.—Lens aberrations.

3. Coma is characterized by fuzziness along the margins of the image due to the light rays forming ovals (pointing to the center of the image) instead of points. It is caused by the unequal refracting power of the different areas of the lens. As you know, the image of a point of light is formed by numerous light rays which are refracted through a relatively wide portion of the lens. In order for them to form a sharply defined point of light inside the camera, the rays which pass through the outer edges of the lens must come to focus at exactly the same point in the focal plane as those passing through the center of the lens. When a lens is causing coma, rays of light emanating from a point on the copy which is not in line with the center of the lens (lens axis) pass through the center of the lens to form a well-defined point, but those rays passing through the outer portions of the lens do not converge to form a single point. Instead, they form several overlapping points, and this creates an egg- or pear-shaped blur along the margin of the image.

Coma can be corrected by the use of a combination of negative and positive lenses, and it can be minimized by stopping down the lens.

4. Astigmatism is the inability of the lens to project a sharply-focused image of both horizontal and vertical lines on the same plane. When this aberration is present, the lens seemingly has two focal lengths–one for the horizontal lines and another for the vertical lines, especially when these lines are in the margins of the image. For example, if you were photographing a crossmark (+), you would find that the vertical line would be out of focus when the horizontal line was focused and vice versa. If you adjust the focus between the horizontal and vertical focuses, the image of the crossmark will be slightly blurred, but the lens will form its best image at this distance. You can reduce the blur somewhat by stopping the aperture down and using only the center portion of the lens.

Astigmatism is corrected by the use of a combination of lenses of different kinds of optical glass. When lenses are corrected for astigmatism and chromatic aberration, other aberrations are corrected simultaneously. However, it is difficult to eliminate astigmatism and at the same time retain a flat field, so there is a negligible amount of aberration in even the best lenses.

5. Curvature of field causes the center of the image to be out of focus when the margins are in focus and vice versa. It is due to the fact that a curved lens cannot form a perfect image at all points on a flat surface. The usual compromise with such lenses is to focus midway between the two extremes and reduce the size of the aperture. The manufacturer corrects this aberration by combining positive and negative lenses of varying radii of curvature. When the lens has been corrected in this manner during manufacture, it is said to have a flat field. The best modern lenses have a noticeable degree of this aberration however, when used with large apertures.

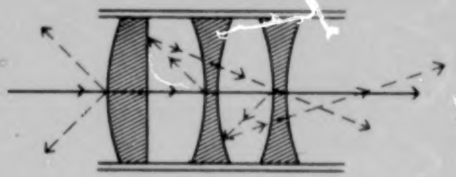
6. Distortion causes the straight lines of the image to appear curved, particularly along the outer margins. It is due to the fact that some areas of the lens magnify more than others. Since the lines are bent in one direction if the aperture is placed in front of a simple lens and are bent in the opposite direction when the aperture is placed behind the lens, it is possible to correct this form of aberration by placing the aperture in the center of the lens barrel between the lens elements.

Flare

Flare or hot spots are nebulous patches of light caused by internal reflections in the lens. Occasionally they originate from spots within the lens mount where the blacking has worn off. You can have these spots repainted to eliminate future trouble.

Flare may also be caused by the lens itself. When the light strikes the first element in the lens, part of it goes through and part of it is reflected. Similarly when it strikes the next element, part of it goes through and part is again reflected. This time the reflected light bounces from the second element back to the first and from there it is reflected again back to the second. Part of it may eventually get through to form a ghost or flare on the negative. (See fig. 5-27.)

Some flare is present in all lenses, but you can reduce it by the use of a lens hood, a dull, black lensboard, a dust-free lens, or a change in the angle of lighting. Lenses are often coated with a chemical solution to reduce optical flare.



57.68

Figure 5-27.—How ghosts are formed in the lens barrel. Center arrow indicates path of light forming image. Broken line represents reflected light.

Care of the Lens

The lens is an extremely delicate piece of equipment and must be handled with great care. Never touch it with your fingers, as fingerprints will cause loss of definition on the negative.

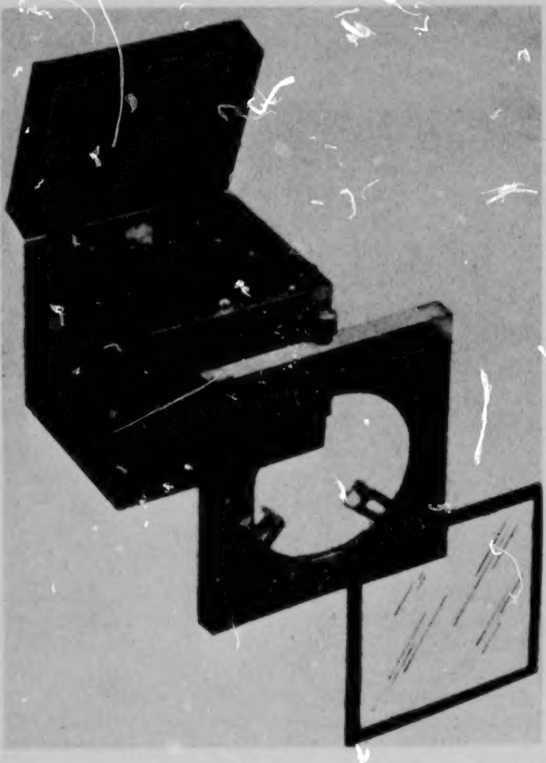
You may brush dust particles from the lens surface with a camel's hair brush, and clean it occasionally with soft tissue (called lens tissue) moistened with a small amount of commercial lens cleaner. Do not use alcohol, polish, or other solvents on the lens.

Never take the lens apart for cleaning; that is a job for the manufacturer.

Lenses should not be stored in places where they are apt to be exposed to extreme temperature changes, nor should they be left exposed to light or air. Always close the filter slot and place a cap over the lens barrel when the camera is not in use.

FILTERS

Although filters are not a part of the camera proper, their use is so closely connected with the lens that they will be discussed at this point. The standard stocked filters used in the Navy consist of a sheet of colored gelatin cemented between two layers of optical glass. These filters may be inserted into a wooden frame mount which slips over the lens barrel and is locked in place with three setscrews. (See fig. 5-28.) There are other types of filters that do not require a separate mounting attachment. You can insert these filters into the filter slot in the lens barrel.



57.707

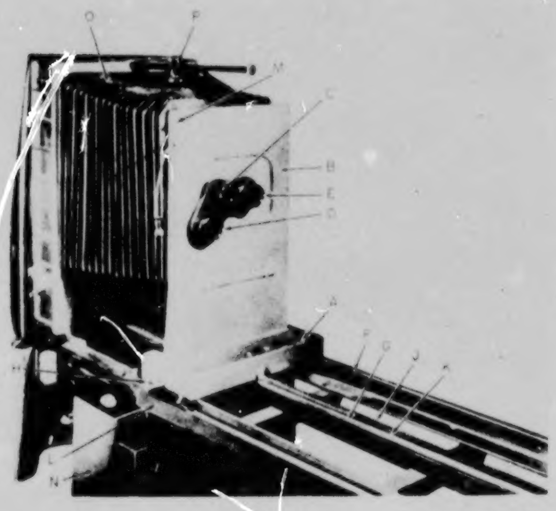
Figure 5-28.—Process camera filters and holder.

Filters are used to alter the color and intensity of the light for color correction and (in process color work) to separate the primary colors of the copy.

If you look at a colored picture through a blue filter, you will notice that the filter practically neutralizes the blues in the picture, while making the yellows look darker so that it will be easy to photograph them. Similarly a red filter will cancel out the reds in the picture, but will make the greens look black.

Yellow filters are frequently used for photographing colored copy. Yellow absorbs blues and some of the violets and gives the negative a more balanced appearance. Yellow filters are also used in copying old papers or photographs that are yellow with age, because the yellow filter causes the yellow background to photograph as white.

Colored filters always absorb a part of the light reflected from the copy. Therefore a longer exposure is necessary when they are used. The number of times by which the exposure must be increased when a filter is used is known as the filter factor. The exposure time varies not only with the color of filter being used but with the type of film and the nature of the light as well. Normally, the film manufacturer supplies this



57.71X

A. Lensboard frame.
B. Lensboard.
C. Lens turret.
D. 12" lens.
E. 16" lens.
F. Track.
G. Guide.
H. Lensboard lock.
J. Copyboard drive assembly.
K. Lensboard drive assembly.
L. Tape rail.
M. Shutter switch.
N. Storage compartment for lens.
O. Bellows.
P. Bellows support rod (keeps bellows from sagging).

Figure 5-29.—Lensboard on a darkroom camera.

information on the film container or on an information sheet which is enclosed in the box.

Filters may throw the image out of focus, so final critical focusing for exact size and sharpness should be made on the ground glass after the filter is in position. Figure 7-11 lists the numbers, colors, and other information regarding some of the filters used by the Navy. You will find more information on filters in Chapter 7.

CAMERA COMPONENTS

There are many makes of process cameras, but no one type is used exclusively throughout the Navy. Units of the fleet and shore establishments are generally permitted to install the type of camera they consider best suited to their needs. The illustrations on the following pages are representative of the horizontal cameras found in use today. Once you have learned to operate a particular camera, you can switch to another type with a minimum amount of instruction.

Lensboard

Figure 5-29 shows the lensboard on a camera. The length of the camera bed and the distance the copyboard and lensboard can be moved limits the amount of enlargement and reduction that can be obtained with a process camera. The camera shown in the illustration has a 90-inch bed and it is equipped with two aprochromatic lenses, one having a focal length of 16 inches and the other, 12 inches. The 16-inch lens is used for the general run of work, but the 12-inch lens may be used for enlargements or reductions greater than those which can be obtained with the lens having the longer focal length.

If you will study figure 5-30 you will see why the 12-inch lens is needed The table shows the distance from the lens to the film, the distance from the copy to the lens, and finally the total distance between the copy and the film. (These distances are arrived at by using the formulas listed on page 114.) The bed of the camera is 90 inches long and the total distance between the lens and film cannot exceed this distance. As you can see in the illustration, it is possible to enlarge or reduce the image 5 times without exceeding the 90-inch distance when you are using the 12-inch lens, but you cannot enlarge or reduce the image more than three times without exceeding this distance when you are using a 16-inch lens.

Ratio of enlargement or reduction	Focal length of lens					
	12-inch			16-inch		
	Lens to film	Lens to copy	Total copy to film	Lens to film	Lens to copy	Total Copy to film
100%	24''	24''	48''	32''	32''	64''
50%	18''	36''	54''	24''	48''	72''
200%	36''	18''	54''	48''	24''	72''
33 1/3%	16''	48''	64''	21.3''	64''	85.3''
300%	48''	16''	64''	64''	21.3''	85.3''
25%	15''	60''	75''	20''	80''	100''
400%	60''	15''	75''	80''	20''	100''
20%	14.4''	72''	86.4''	19.2''	96''	115.2''
500%	72''	14.4''	86.4''	96''	19.2''	115.2''

57.563

Figure 5-30.—Comparison of the various copyboard and lensboard distances required for lenses having 12-inch and 16-inch focal lengths.

You can loosen the knob that secures the turret and swing either of the lenses into operating position when it is needed.

If you are required to secure your lens when it is not in use, you can loosen the knob and remove the turret completely, being careful that the spring behind it does not slip out when this is done. You can lock the turret in the compartment (N) shown in figure 5-29. When you remove the lens in this manner always cover the hole in the lensboard with tape to prevent dust from entering the camera.

Each of the lenses in the turret is equipped with a slot for inserting filters or Waterhouse stops and each has a diaphragm that provides openings ranging from f/11 to f/90.

The shutter on this camera is electrically operated and is built in behind the lens. If you wish to operate it through the timing device, you simply set the dial on the timer for the desired time. Then push the start button. At the end of the time selected, the shutter will close automatically and the lights will go off.

Of course, if you are focusing the camera on the ground glass, you will not want to use the timing device in connection with the shutter. In this case you can switch the lights on separately and then flip a switch on the control box at the back of the camera to open the shutter. The shutter will then stay open and the lights will stay on until you flip the switches again.

In addition to the control box in the darkroom, the shutter can also be operated with the shutter switch (M) shown in figure 5-29 on the side of the lensboard.

You can move the lensboard to the proper position along the scale on the camera bed during focusing by turning a handwheel at the back of the camera. The handwheel moves a chain or gear to which the lensboard is attached. Once the image is focused, you should lock the lensboard in place with lever (H) shown in figure 5-29, so that no movement will occur during the exposure.

The lensboard is similar on other makes of cameras. However, you will find that some cameras are not equipped with a lens turret. In this case, the lens is simply screwed into an opening in the lensboard, and a spare lens may be kept locked in a compartment at the base of the lensboard or elsewhere in the shop.

Some cameras are also equipped with controls at the back which enable you to shift the lensboard horizontally or vertically to center the image on the ground glass during focusing.

Copyboard

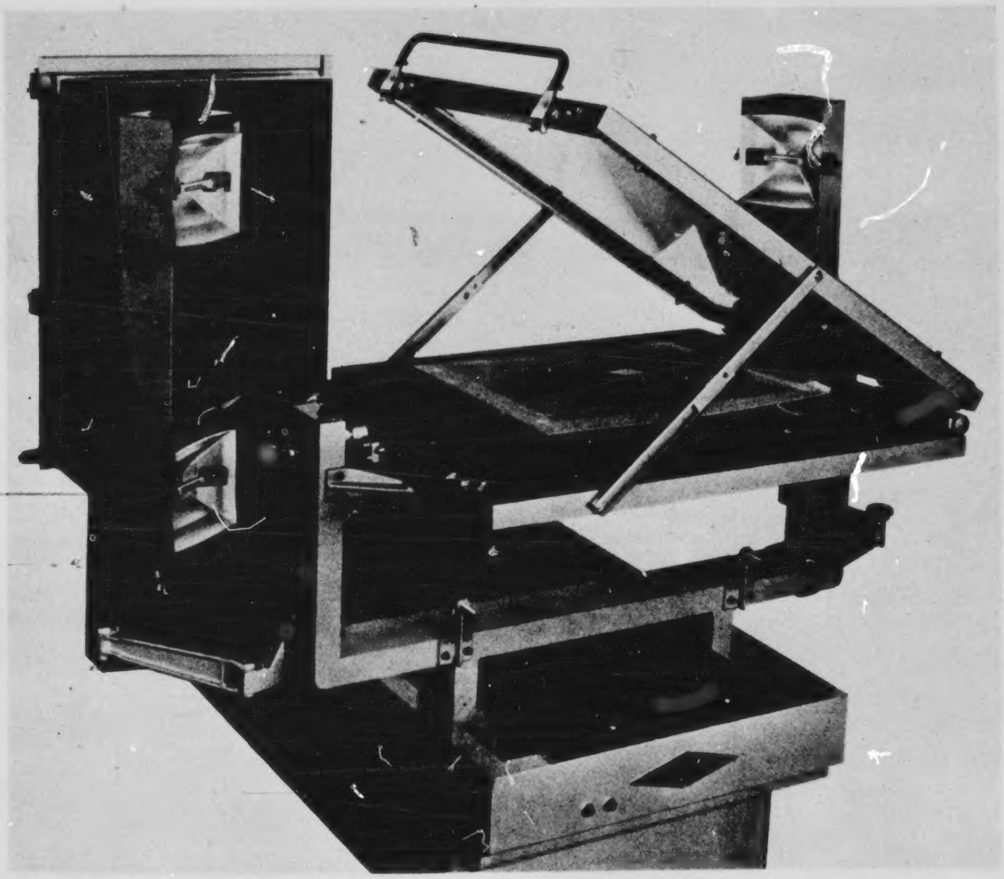
Like lensboards, copyboards vary from one type of camera to another. In some cases, the copyboard consists simply of a bed and a hinged, glass cover. You should tilt it to a horizontal position and open the cover when you are inserting the copy to be photographed. (See fig. 5-31.) After the copy has been positioned on the bed, you should close the cover and swing the frame back to its vertical position for focusing. When the cover is closed the bed squeezes the copy against the glass cover (by means of spring pressure) to flatten it and hold it in place.

Reference lines are generally marked on the felt or rubber surface of the copyboard to aid you in centering and aligning the copy. If the camera does not have these lines, you may draw your own reference marks on linen or paper and fasten it to the copyboard bed.

Some types of process cameras have a vacuum pump which provides suction to hold the copy flat in the copyboard. After the copy is placed in the copyboard and the cover is closed, the pump is turned on before the copyboard is tilted to the vertical position. After the exposure has been completed, the copyboard is returned to the horizontal position and the vacuum pump is turned off before the glass cover is opened.

Always keep the glass of the copyboard clean. You can dust it with a soft camel's hair brush and clean it with a soft cloth and ammonia water or a dilute solution of acetic acid and alcohol. Never use dirty rags or razor blades to clean the glass as they might scratch its surface. If it is necessary to scrape the glass, use your fingernail or a wooden or plastic scraper.

The copyboard can be moved along the scale on the camera bed by means of a handwheel at the back of the camera. Never move the copyboard when it is in a horizontal position, however, and do not leave it standing in a horizontal position. Always be sure that the glass cover is locked before you attempt to move the copyboard back to its vertical position. The glass may break if the cover swings open.



57.73(57C)X

Figure 5-31.—The copyboard in the loading position.

Bellows

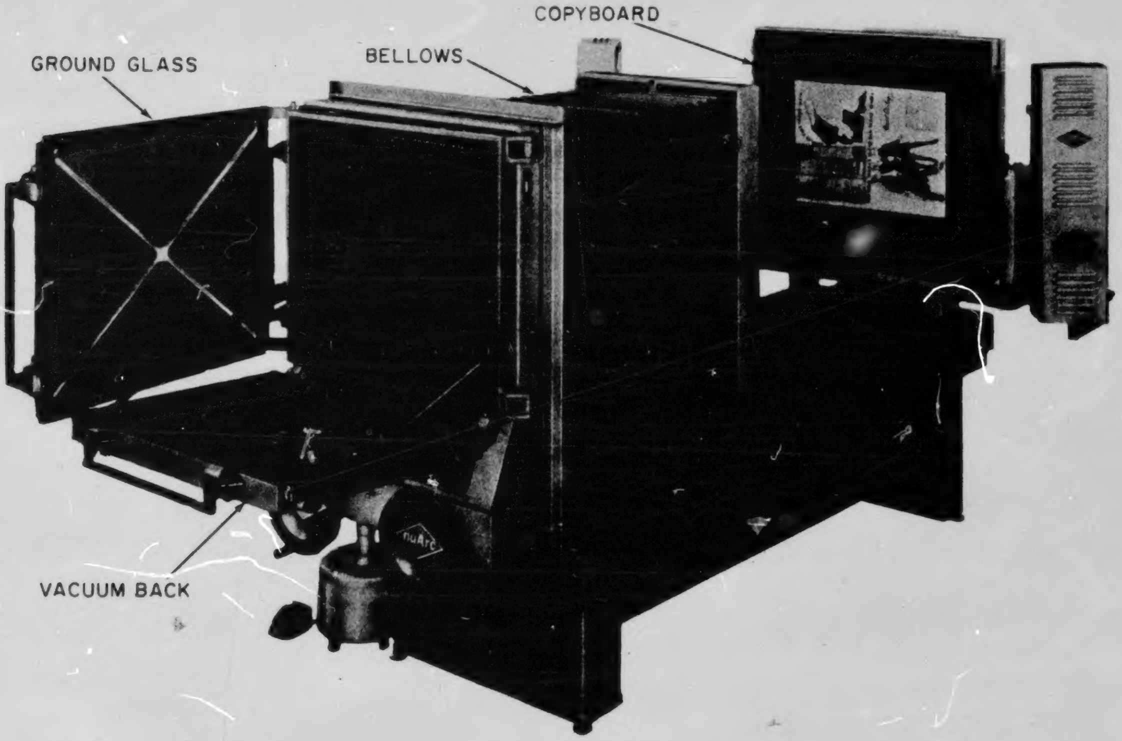
Just behind the lensboard is an accordian-like affair which forms a light tunnel from the lens to the back of the camera. It is called the bellows. (See fig. 5-32.) The bellows consists of specially treated black cloth or leather attached to a series of wooden or metal frames. It is light proof and flexible enough to allow for the adjustment of the lensboard for proper focusing. As you have already seen, the distance from the film to the lens is often referred to as the camera or bellows extension.

You should inspect the bellows occasionally to make sure that it is completely light tight, since light leaks may spoil your negatives.

Ground Glass

The back of the darkroom camera is housed entirely within the darkroom. It is made up of several parts, including the ground glass, the negative carrier, and the camera controls.

The ground glass is usually mounted in a hinged metal frame with its frosted surface in the same optical plane as the film. Sometimes



57.74(57C)X

Figure 5-32.–The darkroom camera ready for loading of the film on the vacuum back. The ground glass is swung back to permit the vacuum back to close. The copyboard is in position for the shot.

the manufacturer leaves clear reference lines in the frosted surface of the glass to aid the cameraman in positioning and focusing the image. (See fig. 5-32.) In critical focusing, the cameraman measures the image with a ruler to see that it is of the proper size, and he examines it with a magnifying glass (linen tester) to see that fine lines are focused sharply. Once the image is in focus, the cameraman swings the glass out of the way (or removes it from the camera) and positions the film carrier in its place.

Vacuum Back

The vacuum back shown in figure 5-32 is a hinged, flat metal door with a series of rectangular channels corresponding to standard film sizes. Each channel is connected to a suction line, and the suction is controlled by a valve. The vacuum should be applied only to the channels for the film size you are using. Some types of vacuum backs have a knob to vary the coverage of the suction; others have slide levers on the reverse side which are positioned for the film size.

The vacuum back in figure 5-32 will accept many different sizes of film. If you are using an odd size piece of film that doesn't fit the vacuum back, you can place small pieces of tape along the edges of the film to hold it flat. Before closing the vacuum back, check to insure that the film is in perfect contact with the vacuum back. You can do this by looking at the film at an angle to catch any reflections from the darkroom safelights. If there are reflections, you should adjust the suction or use tape to make good contact.

The vacuum pump and motor require little attention other than proper lubrication. It is best to have the pump installed outside the darkroom whenever possible.

Halftone Screen Holders

Most process cameras are also equipped with a device for holding a glass halftone screen. Glass halftone screens consists of two sheets of glass, each having a series of parallel lines running across it diagonally. The two sheets are cemented together so that the lines cross each other at right angles to form a checkerboard pattern or screen.

The light is broken up as it passes through this screen and it registers on the film as a series of tiny dots. Since these dots are so small, they blend together to create the illusion of continuous tone.

The halftone screen is not used for all types of copy, it is generally used when the cameraman is copying photographs or tone drawings where he requires a negative with soft, graduated tones rather than plain blacks and whites. But it is not used when he is photographing line copy, such as lettering or pen and ink drawings, because line negatives must be crisp and sharp.

When the glass halftone screen is used, it is always positioned a short distance in front of the film so that the light must pass through it during the exposure. When the screen is not required, it is moved out of the way so that it will not interfere with the light.

The screen is held in place at the back of the camera by two adjustable bars. These bars may be set to accommodate any size of screen. On smaller cameras, the screen may be removed from the camera when it is not needed. On the larger cameras, the two bars are often attached to a track that make it possible for the operator to move it to the side or raise it out of the way when it is not in use.

There are two types of glass halftone screens: rectangular and circular. The rectangular screens are the most common. They are used primarily for black-and-white work. The circular screens are used primarily for color-separations, although they may also be used for black-and-white work.

There is also another type of halftone screen which has a base of acetate instead of glass. It is called a contact screen, because unlike the glass screen which is placed a short distance in front of the film, this screen is placed over the film and is held in direct contact with it by the vacuum back.

You will learn more about halftone screens and how they are used in chapter 8.

Focusing Controls

The copyboard and lensboard are moved into position (focus) from the rear of the camera. To find the focusing points, the cameraman uses a scaling wheel to determine the enlargement or reduction percentages of the copy he is photographing. Figure 5-33 illustrates a typical scaling wheel. When the percentage has been determined the copyboard and lensboard are positioned with the handwheels shown in figure 5-34.

Metal tapes extend from the copyboard and lensboard through an indicator window. The tapes are inscribed with percentage markings to indicate when the copyboard and lensboard are in focus for the size desired. The tapes are read through the viewing window. (See figure 5-34.)

To focus the camera for a same-size shot, each tape is placed at the 100% marking. For an enlargement of 25%, the tapes are set at 125% and so on.

Many larger process cameras are equipped with a vernier dial and counter, which is electrically driven. To focus with this system, the cameraman converts the percentages to a series of numerals with a camera calibration chart like the one in figure 5-35. If you study the illustration, you will see that opposite the 25% in the percentage column, the setting for the lensboard is 641.18 and the setting for the copyboard is 5423.55. To position the lensboard, press the switch that drives the board until 641 appears on the revolution counter. Then turn the small wheel with your fingers to bring the proper "hundreds" reading into the window. The same procedure is followed for the copyboard setting. Vernier dials and revolution counters are illustrated on figure 5-36.

The table shown in figure 5-35 is calibrated for one specific lens. If you switch to a lens with

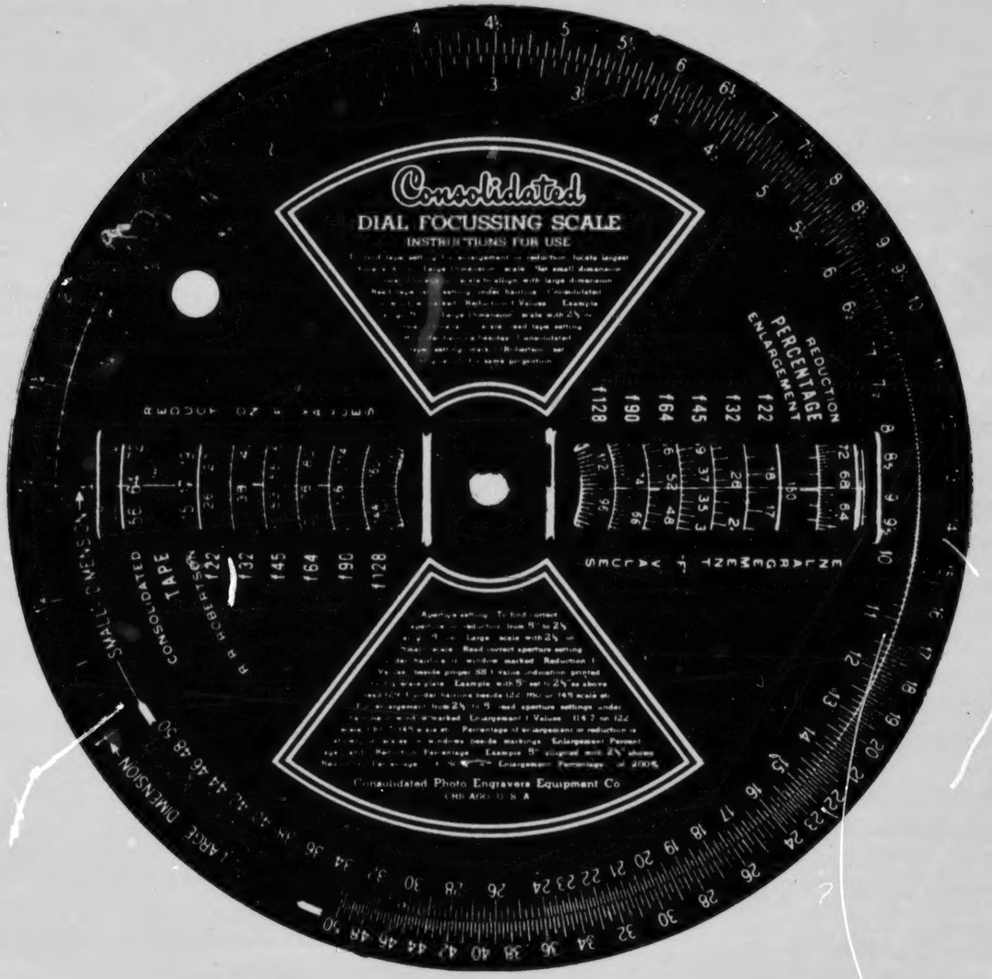

Consolidated
DIAL FOCUSSING SCALE
INSTRUCTIONS FOR USE
REDUCTION
PERCENTAGE
ENLARGEMENT
f128
f90
f64
f45
f32
f22
CONSOLIDATED
TAPE
R. R. ROBERTSON
SMALL DIMENSION
LARGE DIMENSION
Consolidated Photo Engravers Equipment Co
CHICAGO U.S.A.

Figure 5-33.—Scaling wheel.

57.81X

a different focal length, you must use a different table in determining your lensboard and copyboard positions or you must focus on the ground glass by sight.

An understanding of a simple focusing formula will help you to find the positions for your lensboard quickly when you are focusing by sight. This formula is the same as that used in marking the focusing controls for the camera.

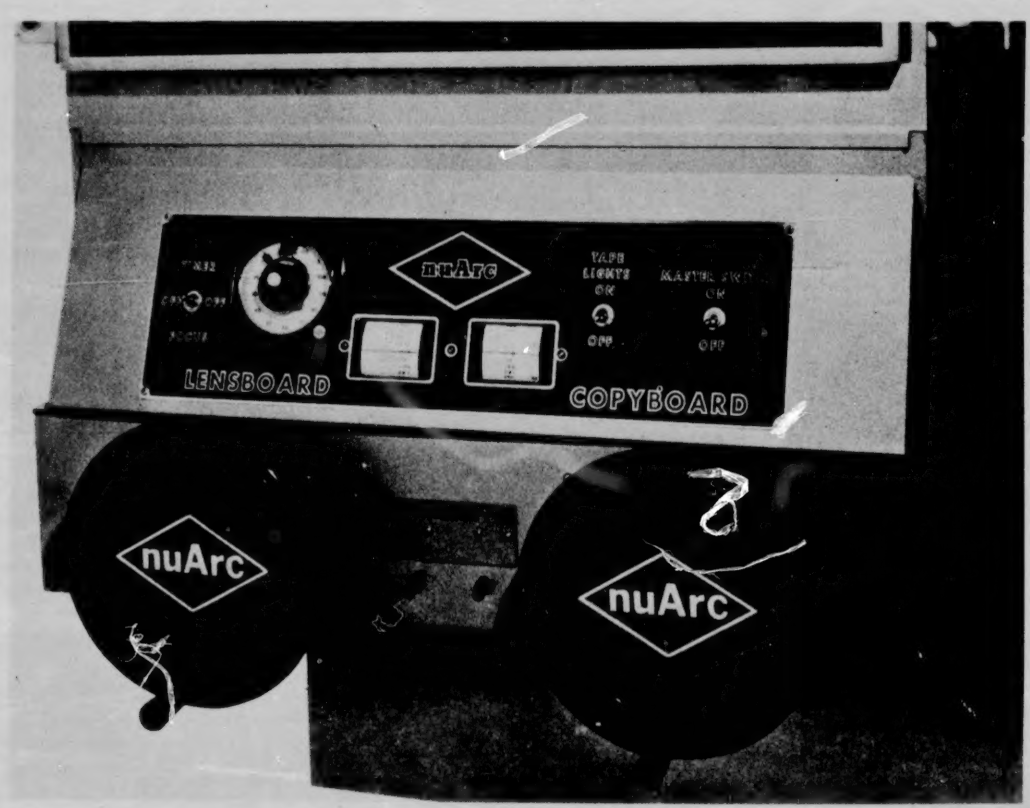
$$\text{Copy to lens} = \text{focal length} \times \left(1 + \frac{1}{\text{magnification}}\right)$$

$$\text{Ground glass to lens} = \text{focal length} \times (1 + \text{magnification})$$

For example, if you are using a 16-inch lens and have the camera set for a same-size shot, the focusing distances would be calculated as follows:

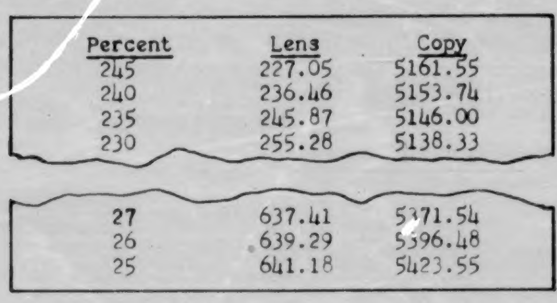
$$\text{Copy to lens} = 16 \times \left(1 + \frac{1}{1}\right) = 16 \times 2 = 32 \text{ inches}$$

$$\text{Lens to film} = 16 \times (1 + 1) = 16 \times 2 = 32 \text{ inches}$$


nuArc
TAPE
LIGHTS
ON
OFF
MASTER SWITCH
ON
OFF
FOCUS
LENSBOARD
COPYBOARD
nuArc
nuArc

57.708X

Figure 5-34.—Focusing controls. The lensboard is positioned by the left handwheel; the copyboard by the right handwheel. Metal tapes extend from the copyboard and lensboard through the viewing window, which enables the cameraman to accurately position them.



Percent	Lens	Copy
245	227.05	5161.55
240	236.46	5153.74
235	245.87	5146.00
230	255.28	5138.33
27	637.41	5371.54
26	639.29	5396.48
25	641.18	5423.55

57.82X

Figure 5-35.—Lens calibration chart.

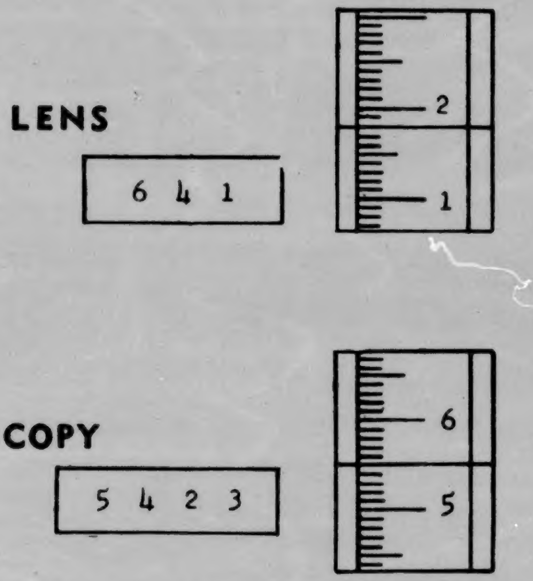
Copy to film = 32 + 32 = 64 inches.

Focusing distances for copy to be reduced one-half would be:

Copy to lens = $16 \times \left(1 + \frac{1}{\frac{1}{2}}\right) = 16 \times 3 = 48$ inches

Lens to film = $16 \times \left(1 + \frac{1}{2}\right) = 16 \times 1\frac{1}{2} = 24$ inches

Copy to film = 48 + 24 = 72.



57.83X

Figure 5-36.—Vernier dials and counters.

Distances for copy enlarged 200 percent (twice size):

Copy to lens = $16 \times \left(1 + \frac{1}{2}\right) = 16 \times 1\frac{1}{2} = 24$ inches

Lens to film = $16 \times (1 + 2) = 16 \times 3 = 48$ inches

Copy to film = $48 + 24 = 72$ inches.

You can use the rated focal length of your lens for calculating purposes. For approximate distances the center of the lens can be taken as a point for all measurements, although in exact calibrations two theoretical points within the lens known as nodal points, must be used. While these formulas will help you to find the approximate positions for your copyboard and lensboard, further focusing on the ground glass may be necessary. Critical or precision focusing should always be done with the lens opening stopped down, and the image on the ground glass should be examined with a magnifier.

Camera Lamps

The sources of illumination of the copyboard on a process camera are termed camera lamps. The lamps may be attached to the copyboard and travel with it, as shown in figure 5-31, or they may be free standing units. The free standing type are positioned according to the position of the copyboard. You will see this type of lamp in use at shore activities and large commercial shops.

The principal requirement of the light source is that it must produce an extremely bright white light which is suitable for both color and black-and-white reproduction. This type of light is said to have a high actinic value, that is, it readily affects the silver salts in the film emulsion.

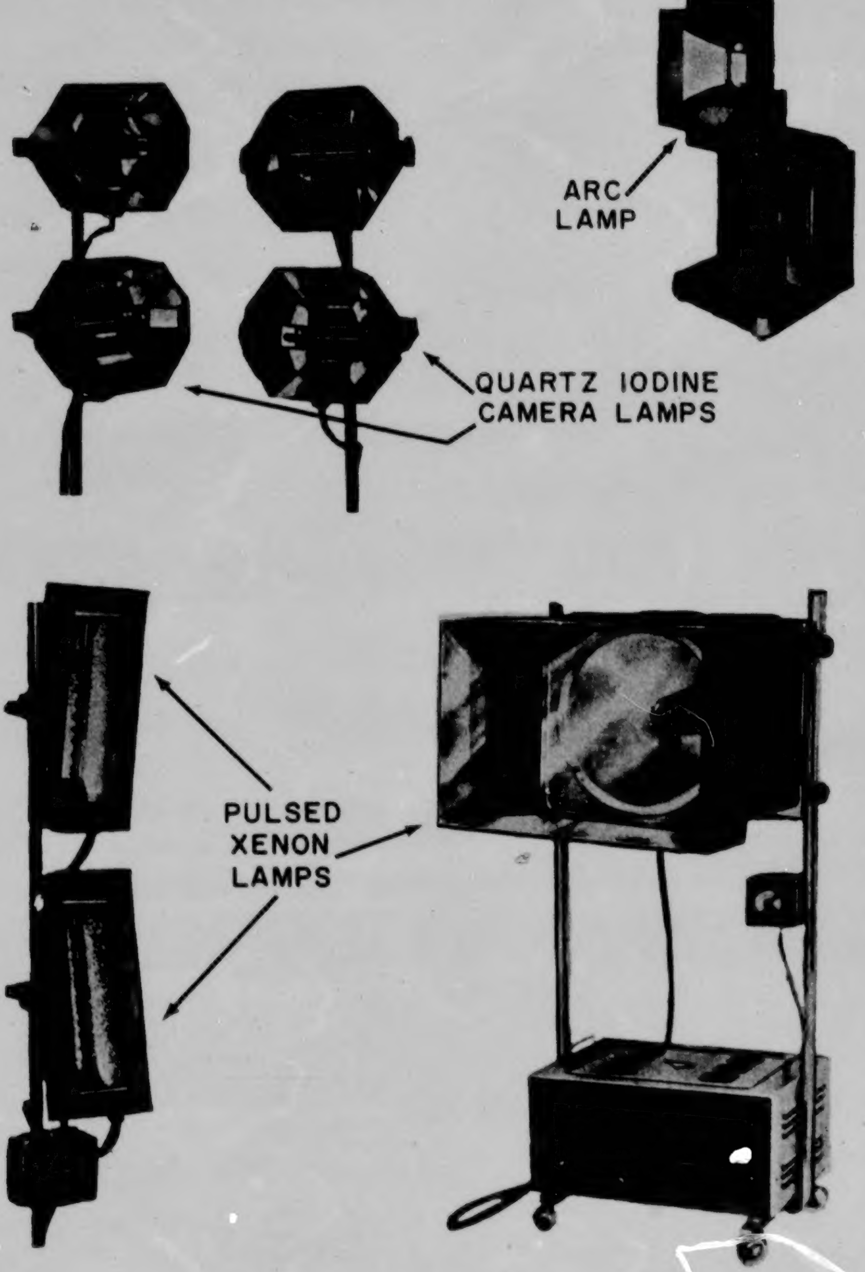
The most useful light sources for graphics art reproduction are the carbon arc, the quartz iodine lamp, the pulsed xenon lamp, and the mercury vapor lamp. (See figure 5-37.)

The use of carbon arc lamps is gradually being phased out in the trade. The other types of illumination eliminate many of the shortcomings of the carbon arcs. The arcs require a burning-in, have minor fluctuations of light, and produce gas fumes and an ash residue.

Camera lamps are placed into one of two categories: the incandescent type or the electric discharge (arc) type.

The pulsed xenon lamp, for example, is of the arc variety. It consists of a tube of quartz glass which is filled with xenon gas and has an electrode at each end. The lamp is said to be "pulsed" because it flashes 120 times a second, although the light output seems constant to the eye. The tubes may be fashioned as coils, semicircles, or angles to fit particular requirements. For example, many of the new lamp holders designed for exposing photo-offset plates are fitted with coiled pulsed xenon tubes.

The iodine quartz lamp is of the incandescent variety, but it bears little resemblance to the conventional light bulb. It consists of a short tube of quartz glass housing a coiled filament which runs the length of the tube. In ordinary incandescent lamps, tungsten evaporates from the filament and settles on the glass to gradually darken the bulb. In the case of the iodine quartz lamp, however, iodine vapor combines chemical-


ARC
LAMP
QUARTZ IODINE
CAMERA LAMPS
PULSED
XENON
LAMPS

57.586

Figure 5-37.—Types of light sources used in litho shops.

ly with the tungsten and causes it to redeposit on the filament. This prevents the tube from becoming tarnished with age. Although the iodine quartz tube is very small (about the size of a fountain pen) it puts out such an intense light that it is particularly suited for use with photolithographic equipment designed to conserve space, such as vertical cameras.

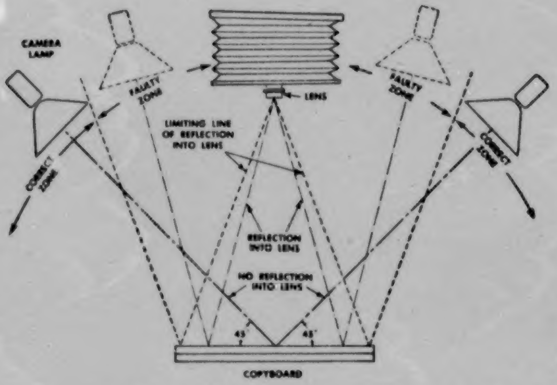
You may also run across the short-arc lamp, which differs from the pulsed xenon lamp in that there is a shorter gap between the electrodes in the tube and the tube has a bulge in the center which corresponds to the location of this cap. Short-arc mercury and mercury xenon lamps are already on the market and short-arc xenon lamps are in the experimental stage. Although mercury lamps produce a very intense light and are often used for black-and-white work, they cannot be used for color work because they do not contain all the colors of the spectrum. They have no red radiation, for example, and this causes all reds in the copy to photograph as black. Xenon lamps produce a light which more closely resembles that of natural daylight.

Positioning the Camera Lamps

As a rule, the lamps are attached to the copyboard and travel along with it. However, they may be adjusted within certain limitations to provide for even illumination. Figure 5-38 shows how the lamps may be positioned in relation to the copyboard to prevent glare. To check for even illumination, turn on the lamps and hold an object centrally in front of the copyboard. The light is balanced when the shadows on both sides of the object have the same tone. It may be necessary for you to adjust one of the lamps in order to achieve this balance.

You must remember, of course, that a change in the lighting arrangement may affect the amount of light being reflected from the copy into the camera. If you shift the lamps, it may be necessary for you to change your exposure time. Exposure time should be calculated according to the law of inverse squares. (See fig. 5-19.)

Some operators use exposure meters for finding the light intensity on the copy to aid them in determining the proper exposure time. You have also seen how light-integrating devices attached to the copyboard determine the amount of light reaching the copy and automatically control the length of the exposure on some cameras.



57.85

Figure 5-38.—Positioning camera lamps. Remember that each change in the distance or angle of the lamps affects the amount of light reflected from the copyboard into the camera. Exposures vary directly as the square of the distance from the copy to the lamp.

CAUTION

The light produced by the various types of camera lamps can cause damage to the human eye. Never look directly into the lamp. When it is necessary to replace or adjust the light source, ensure that the power is off.

Illumination for Large Copy

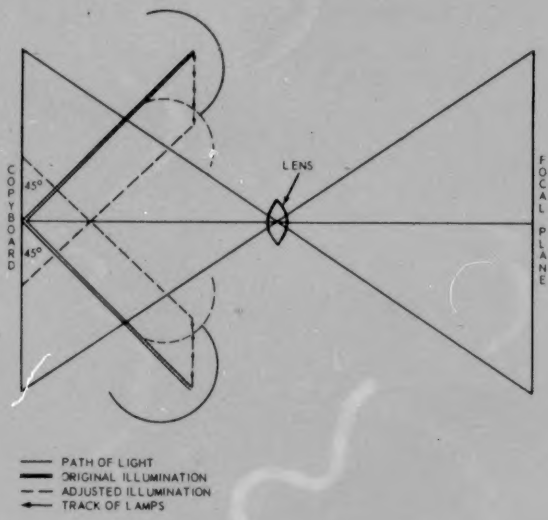
You will notice in figure 5-38 that the camera lamps are positioned at a 45 degree angle to the copyboard. This is the generally accepted "normal" positioning of the lamps. Another generally accepted "norm" is a distance of 3 feet from the lamp center (point of arc, midpoint of xenon tube, and so on). Basic exposures are commonly calculated on this basis of illumination at 1:1 focus at an aperture of f/22. For most work you will encounter, this positioning of the lamps will prove satisfactory. However, there may be occasions when you will be required to photograph a large chart or other piece of copy and the usual exposure will prove unsuitable. This is commonly caused by uneven lighting. As you can see in figure 5-39, light from the outer edges of the copyboard must travel farther to reach the film than light traveling from the center. This causes the light to be weaker along the edges and may result in underexposure of these areas. You can correct this condition by adjusting the camera to the correct focus, using the normal f/22 aperture. Then replace the copy with a sheet of white paper. Keep the lamps at a 45 degree angle, but move them towards the center until the light beams from the lamps intersect in front of the copyboard. Balance will generally be achieved when the beams cross each other at a point approximately one-third of the distance from the copyboard to the lensboard. (See fig. 5-39.) Inspect the lighting on the ground glass to see if it is even from the center to the outer edges.

It is wise to record this data for future reference. Do not forget that the exposure time will have to be adjusted to compensate for the change in illumination.

VERTICAL PROCESS CAMERAS

Up to this point, the discussion in this chapter has centered on the horizontal process camera. Now let's take a look at the vertical process camera and see how it compares with the horizontal camera in principle and operation.

The Kenro camera, shown in figure 5-40, is a typical vertical process camera. It is similar to the horizontal camera in many respects. The position for the camera back is fixed, but you can move the lensboard and copyboard during focusing operations. Some models of this camera will enlarge 200 percent and reduce 50 percent; others enlarge 300 percent and reduce 66 percent. Of course, you can extend the range of enlargement or reduction by using auxiliary lenses, if necessary.



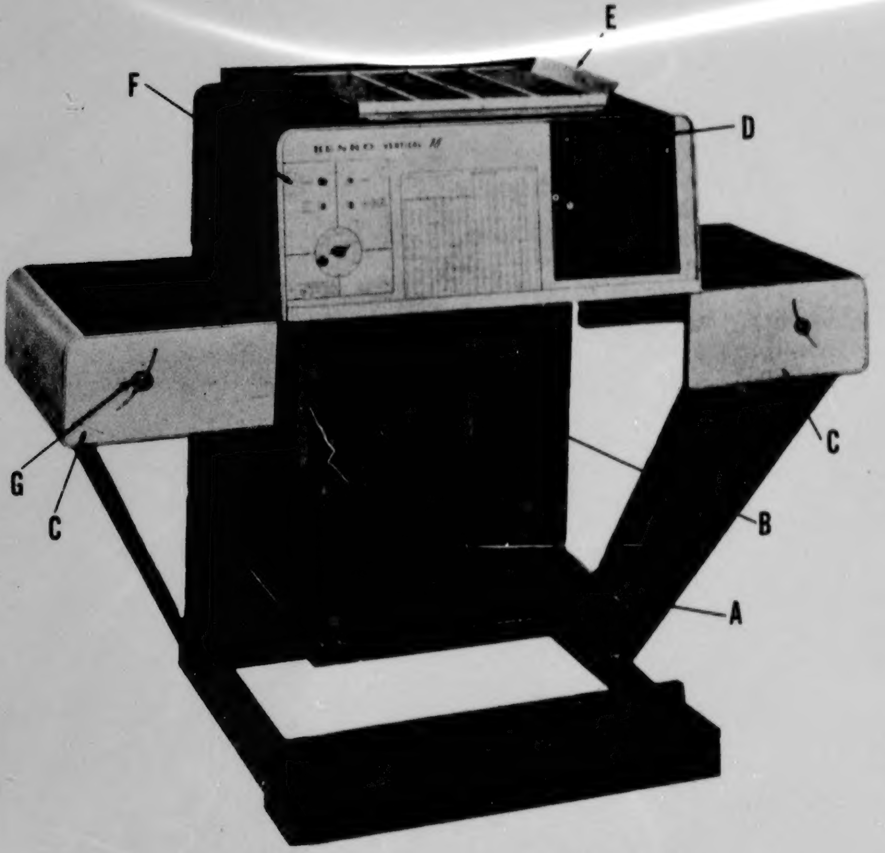
57.587

Figure 5-39.—When photographing large copy, you may get better results if you move the lights until their beams intersect at a point equal to one third of the distance from the copyboard to the lensboard.

The copyboard will take copy up to 18" X 24" in size. The glass frame is hinged at the back and can be opened for insertion of the copy. You should position the copy according to the reference lines on the bed of the copyboard. A pressure back holds the copy tight against the glass when the frame is closed.

Although the back of the camera is usually equipped with a ground glass, which is removed from the camera when it is not in use, focusing is generally done mechanically rather than visually. When focusing, you should use the circular slide rule that comes with the camera to find the percentage of reduction or enlargement required. Once you have found the percentage, you can consult a table to find the setting for your copyboard and lensboard. Then turn the handwheels on the focusing control panel (D), shown in figure 5-40, until you reach the proper numbers on the revolution counters.

This camera may be equipped with a vacuum back or a stayflat back. If the vacuum back is used, it cannot be removed from the camera for



A. Copyboard
B. Lens
C. Light housing
D. Focusing control panel
E. Camera back
F. Exposure control panel
G. Handle for adjusting angle of lighting

57.86X

Figure 5-40.—Vertical process camera.

loading, so the camera must be housed in the darkroom. If the stayflat back is used, the camera can be housed in a separate room, because the stayflat back is detachable and may be taken to the darkroom for loading.

Some models of this camera will take film as large as 18" X 24", and others take film sizes up to 14" X 18".

This camera is not equipped with a glass halftone screen, but you can use a contact screen at the back of the camera in direct contact with the film when you are shooting tone copy.

The camera lights are contained in the housings (C), shown in figure 5-40. On some cameras, each housing has three sockets. Three-hundred watt flood lamps are used in the end sockets and a ruby (or blue) safelight is used in the two center sockets. A switch on the control panel (F) enables you to operate the center lights independently from the others when you are setting up the camera in the darkroom before the exposure.

Some cameras use a different lighting system. On these cameras, lighting is provided by four 500-watt iodine quartz lamps and an intensity booster. You can set the lights for normal or intense lighting with a switch on the control panel. You should use normal brightness during focusing; then turn the lights to high during the exposure.

Handles on the housings enable you to change the angle of the lights, if necessary, to provide for more even illumination.

A device known as the Density Modulator is available for Kenro cameras. It consists of a lighting system located inside the copyboard so that light passes through the copy as the job is being photographed. This is designed to eliminate shadows from creases, paste-ups and overlays, making it unnecessary to touch out shadow lines on negatives. It also provides back lighting for copying film positives and color transparencies.

The Density Modulator has its own reset timer control and relay circuits. It can be operated independently or synchronized with the standard lighting system of the camera.

AUTOMATED CAMERAS

Automatic cameras are now on the market which enable the cameraman to load the film, make the exposure, and develop the film in one continuous operation.

Some of these cameras are fed from a roll of film, the film being automatically cut to the proper length before each exposure; others use regular sheet film. The operator selects the size of film, which is automatically brought into contact with the vacuum back. If tone copy is involved, he moves a glass or contact halftone screen into place. He then sets the lens aperture and makes the exposure. After the exposure, he flips a switch to set the camera on automatic feed.

A film transporting device picks up the exposed film from the vacuum back and carries it to an automatic film processor located in the darkroom. The processor automatically develops, fixes, washes, and dries the film in a cycle of about 10 minutes. Film can be fed into the processor as fast as exposures can be made. The camera controls are located outside the darkroom and the processor can be positioned to deliver the dried negative either inside or outside the darkroom. An automated camera is shown in figure 5-41.

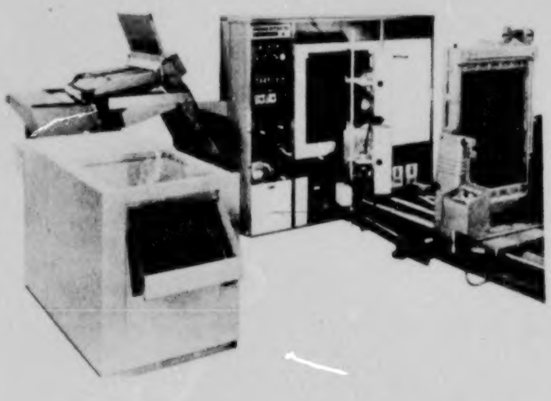
There is another type of camera which produces a plate directly on a specially coated plate material and does not require a negative. It will be discussed in the chapter on platemaking.

Darkroom Equipment

With few exceptions, all photographic processing is done in a light-tight room commonly called a darkroom. There are usually two lighting systems in a darkroom: a normal circuit which is used when film is not being processed, and another circuit which has special lights that must be used when film is being processed. The term safelights is used to describe these lights. They will be discussed in greater detail later in this chapter. Figure 5-42 shows a floor plan of a typical darkroom.

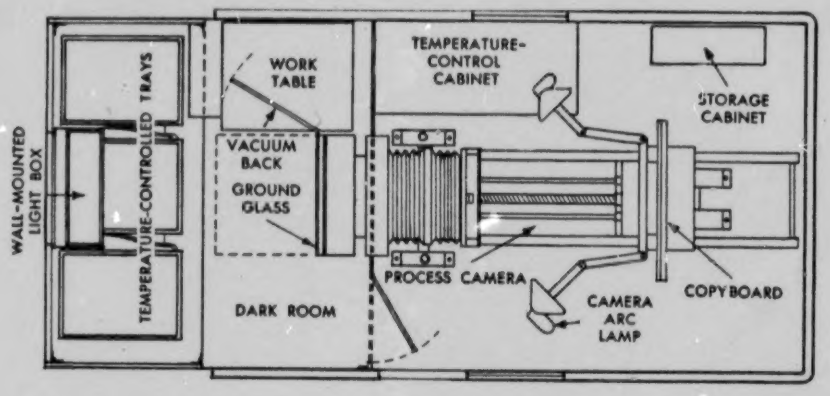
Since photographic materials and processing are readily affected by changes in temperature, an air-conditioned darkroom is desirable. If air-conditioning is not available, the darkroom should be serviced by a filtered blower and a fresh air vent. Another requirement for a properly equipped darkroom is fresh running water.

The darkroom also serves as a storeroom for photographic materials. Since film must be kept cool, many darkrooms are equipped with a refrigerated storage system.



57.589X

Figure 5-41.—Automated camera.



57.89

Figure 5-42.—Floor plan of a typical darkroom.

The following pages discuss the various types of equipment found in darkrooms used for process photography.

Darkroom Sinks

The sink shown in figure 5-43, is where the film is processed. As you can see, there is room for three trays of processing solutions and to the right side there is a viewing glass where the negatives may be examined. The area at the bottom can be used as a storage area.

Another type of darkroom sink is the temperature controlled model. This type is preferable, because it ensures that a constant temperature of the processing solutions is maintained. In addition, the temperature controlled sinks have a refrigerated compartment below where film can be kept.

All darkroom sinks should be thoroughly cleaned at the end of each day. Many expensive sinks have been ruined because they have been neglected. The water bath in the sink collects chemicals which will corrode if it is allowed to stand. Never attempt to adjust the refrigerating system of temperature controlled sinks. That is a job for the engineering or repair department personnel.

Always make sure the power is secured when the sinks are empty. Viewing attachments must be inspected often for leaks that would allow water to reach the wiring and cause an electrical hazard.

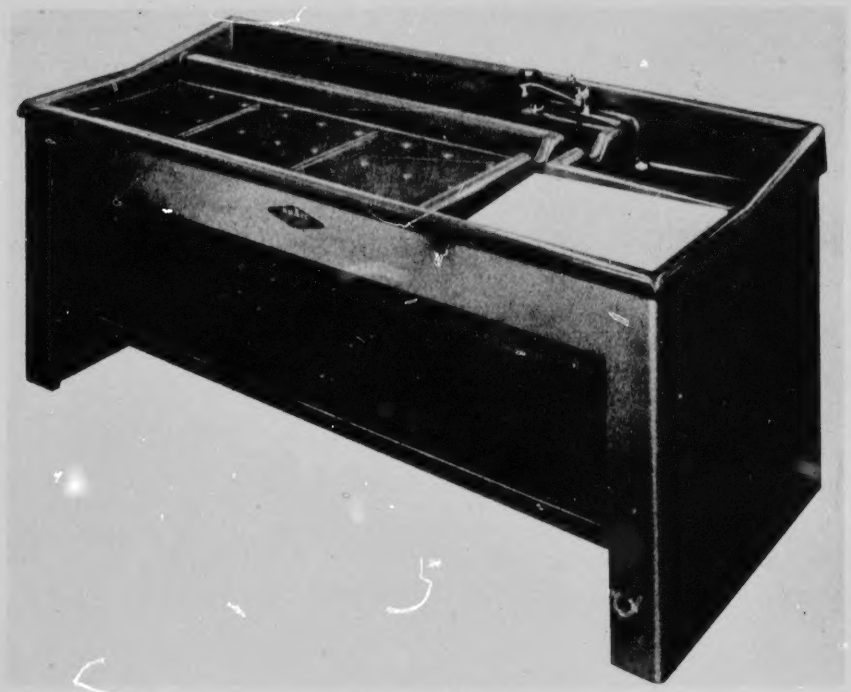
Film Processors

Many large shops use film processing machines similar to the one shown in figure 5-44, to process the film automatically. These machines were mentioned earlier in connection with the automated camera. However, they are not a part of the camera. They are a separate unit and may be used in any darkroom.

After the film is exposed, the operator removes it from the camera and inserts it into a slot in the processing machine. Rollers or belts then catch the film and draw it first through a tank containing developer, then through a fixing bath, and finally through a rinse tank of plain water. The film then enters a drying section where it is dried with warm air before it is ejected through a slot on the other side of the machine. The entire process takes from 2 3/4 to 32 minutes depending on the type of processor and kind of film being processed. The average time for litho film is about 6 minutes.

Densitometers

Many darkrooms, particularly those which produce a large volume of halftone negatives or color separation work, are equipped with an instrument called a densitometer. (See fig. 5-45.) A densitometer is used to measure accurately the density (darkness) of negatives or opaque copy, such as photographs.



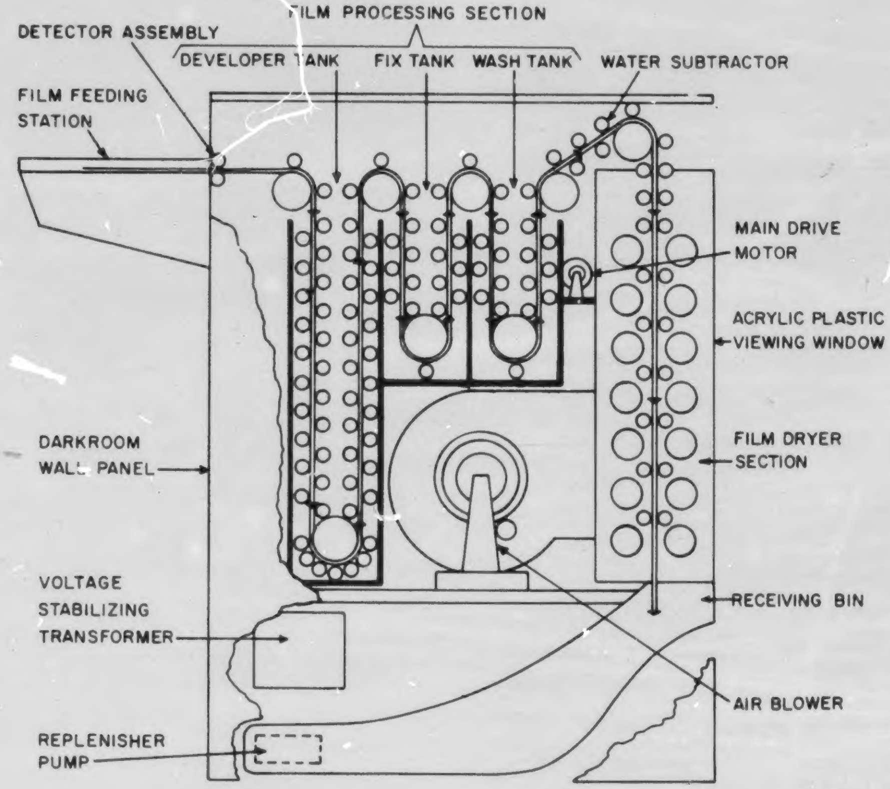
57.90(57C)X

Figure 5-43.—One type of darkroom sink where film is processed.

Areas of the negative or photograph are light or dark according to the density or concentration of the small, black, metallic silver particles deposited on an acetate or paper base. If they are extremely concentrated, they will create a dark tone with high density; and if they are sparse, they will create a light tone with low density. When you are working with opaque copy, such as a photograph, the density is called "reflection density" because you are dealing with the amount of light reflected from the image areas of the print. In the case of film, the density is called "transmission density" because you are dealing with the amount of light passed or transmitted through the silver deposit on the film. (When working with halftones, the density is sometimes called the "integrated tone density", because it depends not only on the size and opacity of the dots, but also on the clear space around them. The density of the individual dots on the negative might read as high as 3.0 on a densitometer, but the transparent, open spaces around the dots subdues their tone so that the integrated tone density will be considerably less. A 90 percent highlight dot, for example, may have an integrated tone density reading of 1.0 and the reading for a 10 percent shadow dot may be 0.05.)

The densitometer is an instrument designed to measure these different tone areas and express the measurements in numbers which can be duplicated, if necessary. You can determine the density range of a negative, for example, by taking a reading in the extreme highlights and extreme shadows and then subtracting the shadow reading from that of the highlights.

Some densitometers are designed to measure the transmission densities of negatives; some are designed to measure the reflection densities of opaque copy, such as photographs; and some are designed to measure both. These "combination densitometers", as they are called, are generally


FILM PROCESSING SECTION
DETECTOR ASSEMBLY
DEVELOPER TANK
FIX TANK
WASH TANK
WATER SUBTRACTOR
FILM FEEDING STATION
MAIN DRIVE MOTOR
ACRYLIC PLASTIC VIEWING WINDOW
DARKROOM WALL PANEL
FILM DRYER SECTION
VOLTAGE STABILIZING TRANSFORMER
RECEIVING BIN
AIR BLOWER
REPLENISHER PUMP

113.70X

Figure 5-44.–Film processor.

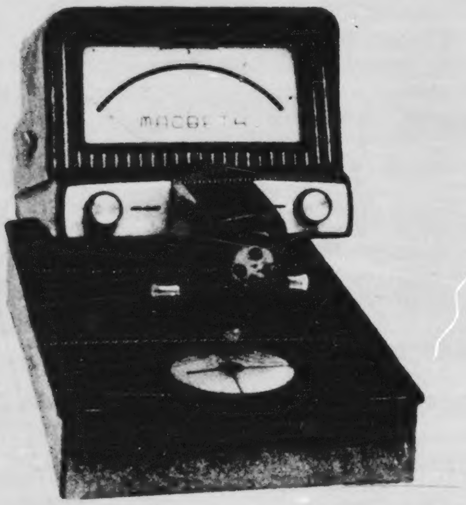
used in the camera department, since the cameraman deals with both negatives and opaque copy. Densitometers can be divided into two general categories: visual (or optical) and photoelectric.

Visual Densitometers

The visual densitometer is simple in design and of relatively low cost. It consists of a system of lenses and mirrors which bring together the tone to be measured and a control tone, which is used for comparison purposes. The operator adjusts the control tone until the two tones match and then reads the density from a scale. Although it is simple to operate, it is not considered as accurate as the electronic densitometer, because it depends largely on visual judgment.

Photoelectric Densitometers

Photoelectric densitometers are so-called because they depend on a photoelectric cell or similar detector to determine the intensity of the light. For transmission density measurements, the negative is placed between a beam of light and the detector and the reading is taken from a meter calibrated in density values. To measure reflection density, the copy is illuminated, then the detector head is passed over the areas to be measured, and a direct reading is taken from the meter. Most photoelectric densitometers, are of the combination type.



57.590

Figure 5-45.—Densitometer.

Practical Application

The densitometer is used extensively in halftone color separation work. You have already seen how to find the density range of negatives by taking readings from highlight and shadow areas and subtracting one from the other. The density range should not vary beyond certain limits from one negative to another in a set of balanced color-separation negatives.

In black-and-white work, the cameraman can use a reflection densitometer to find the density range of the copy and use this as a basis for determining his exposures. In map and chart work, the densitometer is used to measure the various tints which are used to designate depth or elevation. It is relatively easy to identify a 50 percent tint (when you are using a conventional screen), because the dots are square, but if the cameraman attempts to judge other tints by eye, he may find that he is off by as much as 10 percent. For this reason, the densitometer is required to ensure uniformity and accuracy.

The densitometer shown in figure 5-45 is a photoelectric model, similar to the type a cameraman uses to determine the density of a negative. Before taking his reading, he calibrates the densitometer with a test strip of known density values. The negative to be read is placed between the light and the detector. The resultant reading is obtained from the meter scale, which is calibrated in density values. Some models eliminate the meter scale by giving the density value in digital form. The resultant density value is flashed upon a small screen with this type of densitometer.

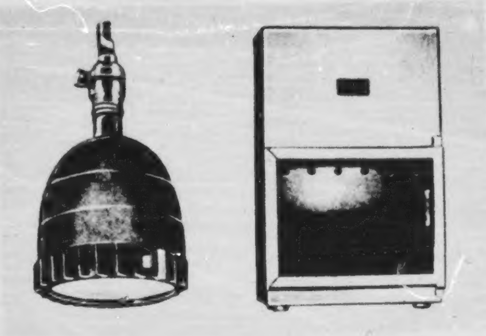
It is possible to remove the head containing the photoelectric cell from some densitometers and move it to various positions on the copyboard or ground glass of the camera to check for even illumination. It can also be used as an illumination meter in calculating filter factors and exposures.

Besides its use in the camera department, the densitometer may also be used in the pressroom and plate-making room and for evaluating colored inks and papers.

Safelights

Film is sensitive to almost every kind of light if exposed to it long enough. For practical purposes, however, you can use certain colored lights in the darkroom. These lights are called safelights. The type of safelight required depends on the kind of sensitized material you are handling. (See figure 5-46.)

Since photographic materials cover a wide range of sensitivity to light and color, a corresponding series of safelights is needed. The red



57.92

Figure 5-46.—Safelights.

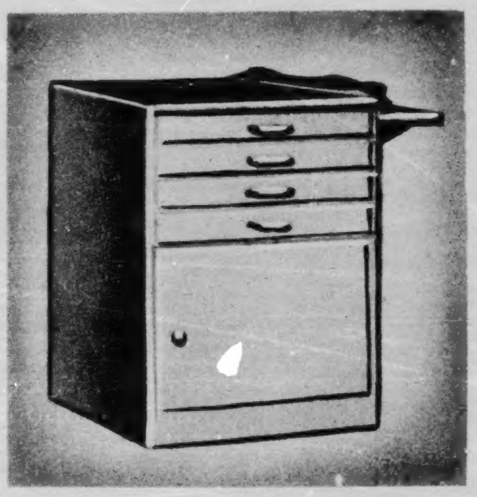
(series 1) filter can be used with certain films that are sensitive only to violet and blue colors. (These films are known as monochromatic or color-blind films.) Other films coated with orthochromatic emulsions are sensitive to all colors except red and can be handled safely under a red (series 2) or a light red (series 1 A) safelight. Panchromatic film emulsions are sensitive to all colors and should be processed in total darkness. (Panchromatic film may be inspected under a green light (series 3) after the first few minutes of processing.) Orange and yellow-green lights are usually safe for photographic paper.

If you are in doubt as to whether the safelight that you are using is safe for a given type of film, check the specifications printed on the film box. Always keep your work at least 3 feet away from the safelight. Light leaks, high-wattage bulbs, and bleached lamp filters may fog the film.

Ruby or amber light bulbs are sometimes used for general lighting (depending on the purpose of the darkroom). They should be placed high on the bulkhead or overhead. They are not safe as safelights, but will not cause appreciable damage if you keep the work at a satisfactory distance from them.

Film Cabinet

The film cabinet, shown in figure 5-47, is typical of those used in shipboard darkrooms. It has four light-tight drawers for storing open film and a cabinet beneath for packaged film storage. The top is often fitted with a paper cutter.



57.93

Figure 5-47.–Film storage cabinet.

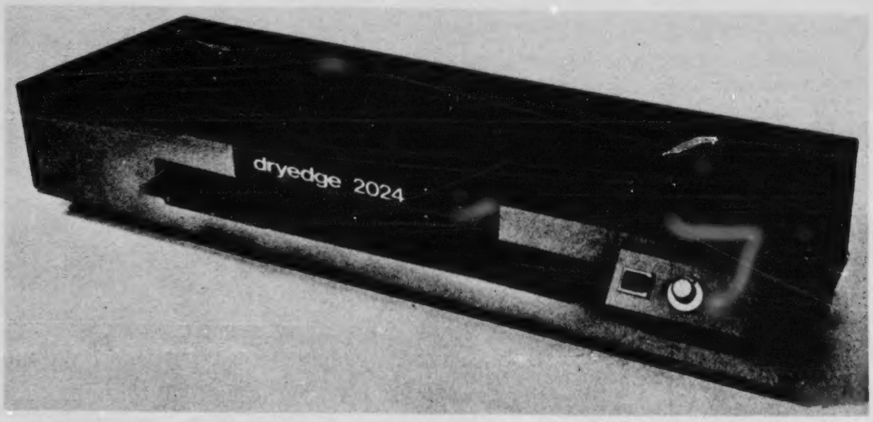
Film Dryers

After developing and fixing the negatives are washed in plain water. When the washing is completed, the film must be dried. In small shops, film is dried by hanging it with clips or pins to a line much the same as you would hang clothes from a clothesline.

Many Navy shops are now installing film dryers. The Dryedge film dryer shown in figure 5-48 will take film as small as 4″ X 5″ and as large as 20″ wide by any length. It is capable of drying a sheet of 20″ X 24″ film in 24 seconds. It does not have a regular heating unit; however, the pump motors generate a small amount of heat which is utilized in drying the film. The temperature of the dryer seldom exceeds 119° F and this relatively low temperature helps to preserve the dimensional stability of the film. You should allow about three minutes for the machine to warm up at the beginning of the day or after a long shut-down period. When you are using a dryer, you should make sure that your fixing solution contains hardener, that the solution is not too old, and that the wash water is fresh, cool, and clean.

Feed the film into the machine dripping wet. It is not necessary to squeegee it because the excess water is squeegeed off by the rubber rollers as it enters the machine. This water does not go inside the machine, but drips down the rubber feed guide on the front. It is therefore desirable to place the dryer so that the feed guide is over a sink or a tray into which it can drip. Do not let water accumulate under the machine, because the water may be drawn into the manifold when the machine is running. Stainless steel and anodized aluminum are used in the construction of the machine to prevent corrosion.

This dryer is designed primarily for lithographic film 0.004″ thick or heavier. Film 0.003″ thick can be fed with some degree of



113.277X

Figure 5-48.—Dryedge film dryer.

success, but thinner films do not feed consistently well.

To feed film into the dryer correctly, you should hold it on both sides about 2" from the leading edge and pull out so the leading edge is drawn taut. This edge must hit the first rollers squarely. It requires some practice to feed the larger, thin based film correctly. It is a good idea to put at least 20 pieces through the machine in a practice run to enable you to develop a feeding technique.

All films and emulsions do not dry at the same rate. Even the same film will dry more slowly on one day then it will on another due to the relative humidity of the atmosphere. Normally when you are handling Estar, Cronar, and the polystyrene bases, you can operate the dryer at a faster speed than you can when you are drying acetate films, especially Royal Ortho and Bell and Howell films, which dry very slowly.

A speed control knob controls the rate of travel of the film though the machine. Turning the knob to the right speeds up the dryer. You should keep the machine running as fast as is consistent with good drying.

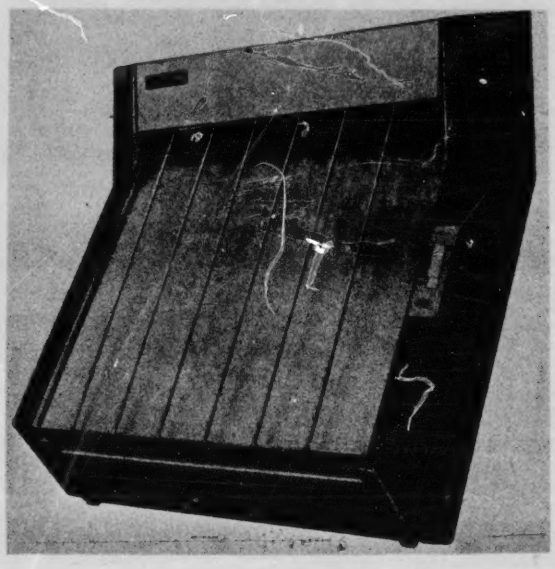
Another knob controls a plate leading from the air intake to the muffler. You have just seen that there is no heating element in the dryer and the heat is supplied from the pump motors. By pulling the knob out, you can close the damper and this will cause the air heated by the motors to recirculate. If you push the knob in, the dryer will take in fresh air and will not dry the film as fast.

You should replace the intake filter pad every three months or after approximately 250 hours of operation. You should also remove the entire drive and air mechanism for cleaning about every three months in normal operation.

First remove the two machine screws securing the two horizontal cover panels. (Note that they are not interchangeable.) Remove the four nuts on the bottom of the machine housing; then lift out the mechanism which includes the two motor pumps and the drive motor and roller assembly. (You must unplug these elements to remove them.) The roller assembly should be given a spray bath with warm water and a mild detergent. The motors are housed to resist normal splash, but under no circumstances should they be submerged. While the machine is open, place a plastic liner in the bottom near the front where the framework is provided. Usually there will be a build up of foreign matter and this should be removed.

Southwind Automatic Film Dryer

Another type of dryer is shown in figure 5-49. This machine consists essentially of a heating



113.278X

Figure 5-49.—Southwind automatic film dryer.

and blowing unit and sets of rollers and belts which carry the film through the machine and eject it dry and ready for use. The average drying time for a 14" X 20" sheet of film is approximately 2 minutes.

As you can see in the illustration, this machine is generally mounted on the bulkhead over the darkroom sink. The operator feeds wet film into it without squeegeeing off the surplus water. The film must be fed down the center of the dryer with the leading edge square with the feed-in rollers. The rollers grasp the film and pull it into the machine, squeegeeing off the excess water in the process.

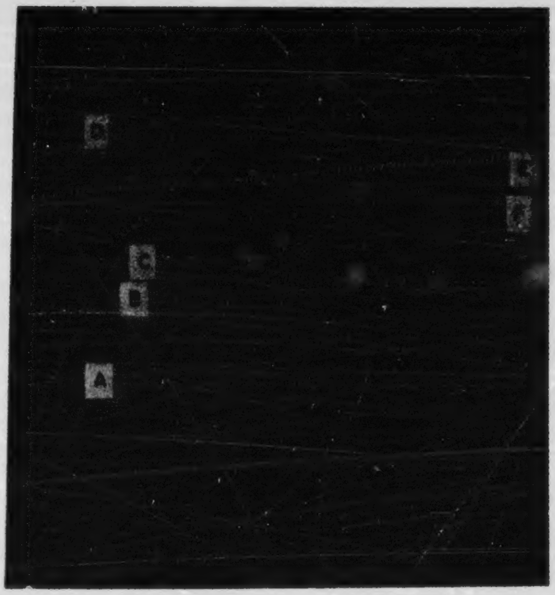
Forced hot air dries the film as it travels along. When it reaches the top of the machine, it passes around a drum which causes it to make a U-turn and emerge from the machine into the delivery tray (on the top of the dryer) dry and ready for use.

A four-button switch is used for regulating the temperature of the machine as well as for starting and stopping it. The buttons on this switch are marked "Low," "Medium," "High," and "Off." The "Off" button not only shuts off the heat, but also turns off the drive motors.

The amount of heat required for drying is determined by the relative humidity of the room and the type of film being dried. You should always use the lowest temperature that will dry the film properly. The "Medium" heat setting is used for the average run of work, and approximately 5 minutes warm up time is required when the machine is started at the beginning of the day.

Film thinner than 0.004" is difficult to feed through the machine because of curl.

If the film jams in the machine, lift the receiving tray (D) shown in figure 5-50, and remove the airducts (A) by lifting them out with the handles provided. If the film is wrapped around one of the rollers, lift and pull to the side tension bracket (C) on each end of the roller part (B). Be careful not to lose the



113.279X

A. Air intakes.
B. Roller.
C. Slide tension bracket.
D. Receiving tray.
E. Belts.
F. Belt tension roller.

Figure 5-50.—Removing film caught in the dryer.

bearings on the end of the roller as you lift the roller out to remove the film. Once the film is removed, you can replace the roller by re-engaging the tension brackets. Then lower the receiving tray and resume operations.

The air filter is located at the back of the dryer and simply slips in and out. Replacement filters are of a standard size that is available at most hardware stores.

You should inspect the filter and rollers periodically to see that they are clean. You can clean the rollers with a soft cloth dampened with water. You should also keep the receiving tray clean to avoid the possibility of contaminating the film after it has emerged from the machine.

Timers

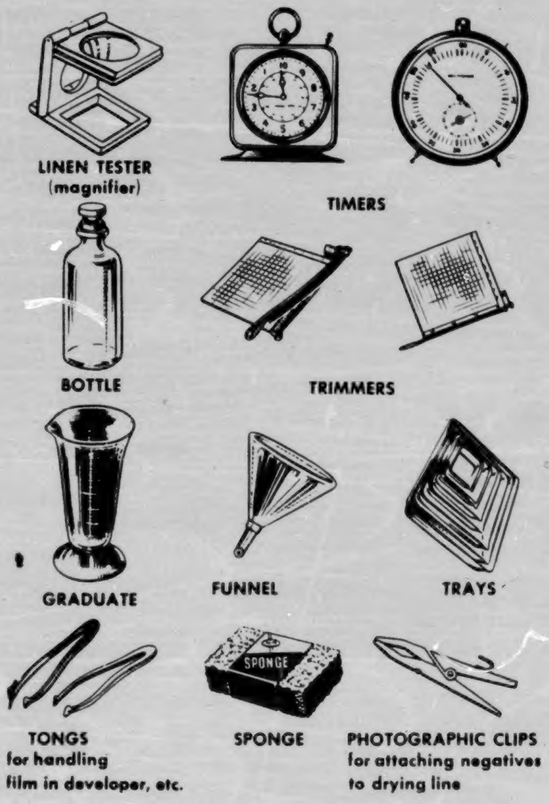
The timer shown in figure 5-51 is a clocklike device that can be set to signal the cameraman when a predetermined time has elapsed. It is used in film processing and similar operations. The operator sets it by turning a knob to move the dial hand to the figure indicating the desired time. He then places it in operation by depressing the spring-actuating lever on the rear of the timer, or by moving a sweep hand to the zero position and releasing it. At the end of the time interval selected, a bell will ring to signal him that the time is up.

Electric timers like those found on the cameras and on photographic enlargers are generally set by moving a pointer to the figure indicating the desired time and then operating a pushbutton switch mounted below the dial. The electric timer terminates the exposure automatically at the completion of the set time. It is especially useful when repeated exposures of the same duration must be made.

PHOTOGRAPHIC PRINTING EQUIPMENT

In your work, you will print most of your negatives on metal plates. However, you may also be called on to make positive copies on film or paper. Positive copies on film are known as film positives and positive copies on paper are known as prints.

These positive copies may be made by either contact or projection printing. Contact prints are made in a printing frame that holds the negative and sensitized material in perfect contact with one another during the exposure and projection prints are made with an enlarger.

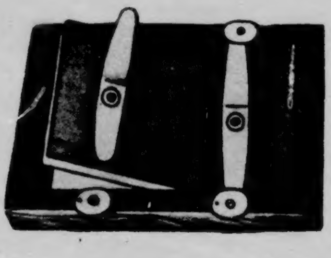


57.94

Figure 5-51.—Miscellaneous darkroom equipment.

Printing Frames

The simplest printing frame consists of a wood, metal, or plastic frame with a glass front, and a padded, spring-clamp back. (See fig. 5-52.) Negatives and paper are held emulsion to emulsion between the glass and the back and the exposure is made by turning the glass to the light. Such a frame will serve for small jobs, but it is too slow to be of much value if there is much of this type of work to be done.

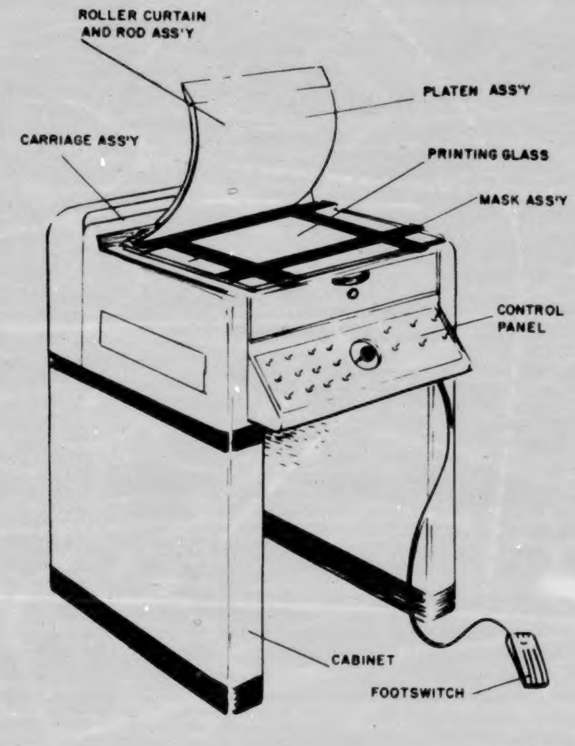


57.95

Figure 5-52.–A printing frame.

Contact Printers

The contact printer, shown in figure 5-53, is more suitable for the average run of work. It consists of a hinged cover which clamps down over the glass and holds the paper in tight contact with the negative, at the same time switching on a light inside the box to provide the exposure. The exposure ends when the cover is lifted, although a small ruby lamp remains lighted inside the light box throughout all printing operations. The photographer uses this light in positioning and judging the negatives.



57.96(57C)

Figure 5-53.–Contact printer.

A metal masking device is used to provide white margins around the prints. It consists of thin strips of metal which can be adjusted to accommodate any size of negative or margin. One-half inch margins are generally allowed for 8" X 10" prints, and one-fourth inch margins may be allowed for smaller sizes.

The masking device sometimes prevents absolute contact between the negative and the paper. This causes the edges of the image to be blurred. You can eliminate such trouble by using a mask cut from thin black paper instead of the regular masking device.

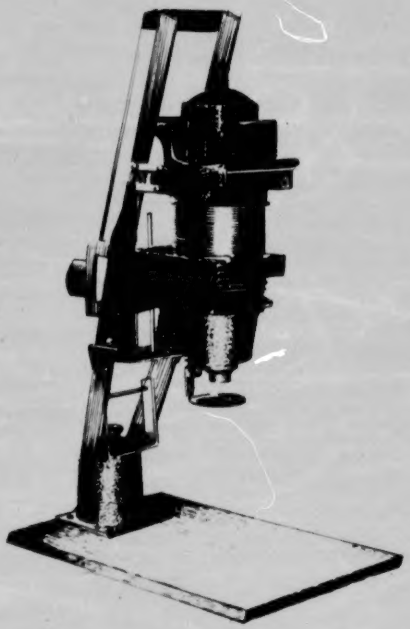
Vacuum Printers

The printing frame and contact printer are generally used only for making prints on photographic paper. For positive prints on film, a vacuum printer or a vacuum frame is generally used to ensure the close contact required for fine line and tone work. You will learn more about film positives later.

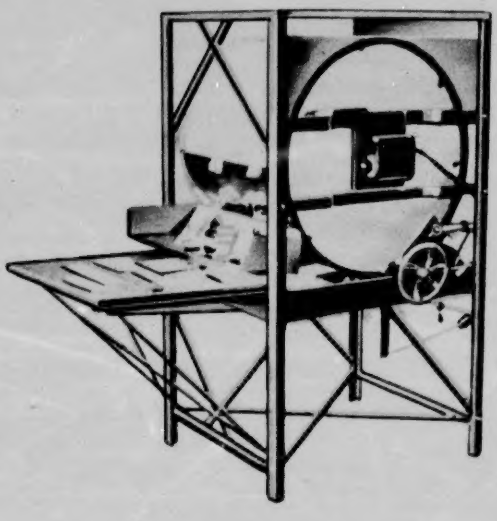
Projection Printers

There is another method of making photographic prints, known as projection printing or enlarging. The enlarger projects negative images onto a sheet of photographic paper or film, much the same 35-mm slides are projected. The image may be brought to focus anywhere from a few inches to several feet from the lens of the enlarger. (See fig. 5-54.) An enlarger is essentially a camera in reverse because it projects rather than receives the image.

Enlargers are very useful for making film transparencies. Precision enlargers specially built for the graphic arts are used for producing color-separation negatives from color transparencies in many of the large commercial shops specializing in color-separation work.



57.98
Figure 5-54.—Projection printer (enlarger).



57.99
Figure 5-55.—Print drying machine.

Print Drying

In some shops, paper prints are washed in a mechanical washer. Then the matte and semimatte prints are dried face down on a piece of cheesecloth or between sheets of blotting paper. Glossy prints are generally dried on a thin metal plates, called ferrotype plates or tins. These plates have a polished surface that gives the prints their high gloss. The wet prints should be squeegeed (pressed) onto the plate, and they will pop off as they dry. The tins are sometimes heated to speed the drying process.

A print-drying machine, like that shown in figure 5-55, is found in large photographic establishments. It is actually a ferrotype drum. The wet prints are laid on a canvas belt which carries them to the drum, where the emulsion side of the prints is pressed against the drum by rubber rollers.

Since the drum is electrically heated, the prints dry very quickly, popping off against the canvas belt, which carries them around and drops them in a basket. Matte prints may be dried on the drum if they are run through the machine with the emulsion side down against the canvas belt.

Miscellaneous Darkroom Equipment

Figure 5-51 shows several miscellaneous pieces of darkroom equipment. Always handle thermometers carefully, as they are very fragile. High temperatures may burst the bulb, and severe jarring may separate the mercury column. You can sometimes reunite a separated mercury column by swinging the thermometer rapidly with the bulb outward or by heating it gradually in a pan of water. Graduates, funnels, pans, stirring rods, and trays must be kept spotlessly clean to prevent the chemicals from being contaminated and to prevent dried crystals from flying about in the air.

VARIATIONS IN EQUIPMENT

This chapter has covered most of the equipment you are likely to come across in the darkroom. However, because of the variations found in lithographic establishments, the material here is not applicable to all plants alike. Nevertheless, you will profit by studying the whole chapter, because sooner or later you will be coming across most of the equipment discussed here.

SAFETY IN THE DARKROOM

There are several hazardous situations present when the lithographer is working in the darkroom with photographic equipment. It is important that you recognize them and eliminate them whenever possible. Safety on the job is your responsibility.

The following are points to remember when you are working in the darkroom:

1. Never touch a plug, switch, or any part of an electrically operated machine with wet hands, or while standing on a wet deck. Keep a towel handy to dry your hands.
2. Insure that all equipment has been properly safety checked by the electrical shop personnel.
3. Never "jury-rig" equipment to operate it. The use of long extension cords should be avoided. It is easy to trip or stumble over them in the safelit darkroom.
4. Clean up all spills immediately.
5. Whenever you are replacing components or adjusting equipment, secure the power at the source. Don't attempt repairs to motors or switches. That's a job for the electricians.
6. Don't lean on the glass of light tables. A severe injury could result.
7. Report all accidents to competent authority. The investigation of one accident could prevent others.
8. All injuries should be reported to the medical department when they occur. What seems minor when it occurs could develop into something serious without prompt attention.

CHAPTER 6

PHOTOGRAPHIC MATERIALS

PHOTOGRAPHY AND CHEMISTRY

Photography has been described as a scientific art based on chemistry and physics. Chemistry deals with the composition of matter and the changes that occur when substances are taken apart or combined. Physics is the study of energy (light, heat, sound, electricity, etc.) and its effect on matter. It is not necessary that you have a detailed knowledge of these sciences, but you should be familiar with the fundamentals contained in this chapter to help you understand the photographic processes.

Certain substances, such as carbon, iron, sulphur, oxygen, and so on, are known as elements. Elements are basic matter–they cannot be broken down or divided into other substances by chemical means. All matter–even water and air–is made up of elements or combinations of elements. Elements may be combined in a fixed proportion to form a compound. Water is a compound. It always contains two parts of hydrogen, by weight, to one part of oxygen; the formula for water is H_2O. Some combinations are not in fixed proportions, and are called mixtures. Table salt in water, for example, is a mixture of liquid and solid, as the salt and water ratio can be varied (within certain limitations) and will remain salt and water. The air you breathe is a mixture of gases. Air is composed of approximately 78% nitrogen, 21% oxygen, and 1% other gases and water vapor. You may be familiar with polluted air in some large cities. Such air contains much more than the 1% of other gases.

The elements are divided into two main classes: the metals, such as silver, aluminum, and iron; and the non-metals, such as carbon, oxygen, and sulphur. Each class of elements has certain chemical properties which distinguish it from the other class. These properties are those which deal with the way the elements react with the other elements. (There is a third class of elements, the inert gases, such as helium, which do not react with any other elements.) Metals react with non-metals, but not with metals; non-metals react with both metals and non-metals.

The most common chemical reaction is that between oxygen and other substances. This reaction is known as oxidation, and the product of oxidation is known as an oxide. The oxidation of iron results in iron oxide, commonly called rust. Oxidation may result from exposure of a substance to air or water or from contact with another substance which will readily yield oxygen. The substance releasing the oxygen is called an oxidizing agent, and the material causing the release is known as a reducer.

ACIDS, BASES AND SALTS

Many oxides are soluble in water. The oxides of metals combine with water to form bases or alkalies. A base is bitter to the taste and turns red litmus paper blue. The non-metals combine with water (which contains hydrogen and oxygen) or with hydrogen alone to produce acids. Acids are the opposite of bases in their reaction. They are sour to the taste and turn blue litmus paper red.

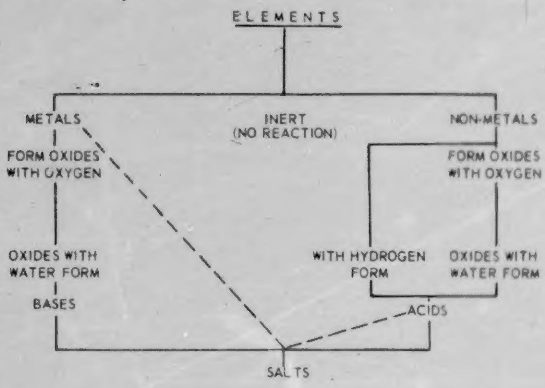
When an acid and a base, or an acid and a metal, are combined, a reaction takes place, called neutralization. Neither acid nor base (nor metal) remain; instead, a new compound is formed. It is called a salt. Sometimes neutralization is not complete. This depends upon the amount of hydrogen present in the two reacting substances (reagents). As you have seen, all acids contain hydrogen, which is usually released in the form of bubbles during neutralization. If all the hydrogen is displaced, the salt will be neutral; if some remains, the salt will be an acid salt or a basic salt, depending upon which of the reagents was stronger.

Figure 6-1 illustrates how elements combine to form other substances.

Measuring Acidity and Alkalinity

You have seen that a base is bitter to the taste, and that an acid is sour to the taste. You have also seen the reaction of litmus papers to acids and bases. Determining alkalinity and acidity by these means is not accurate as to degree. In the case of a strong alkali or acid, testing by taste could be extremely dangerous.

Since accurate measurements are needed in scientific applications, a system has been devised for measuring the degree of activity of the acid or alkali in solution so that it may be expressed in numerical values. These values may then be recorded and duplicated at any time. This system is known as pH control, and the degree of activity of the acid or alkali in the solution is known as the pH value.



57.100

Figure 6-1.—How elements combined to form other substances.

The pH control system is of great importance in all scientific work, and is used extensively by many industries. In lithography, it is used chiefly for testing plate coating solutions and press fountain solutions. You will learn more about each of these solutions later.

The pH values are measured with a scale of numbers ranging from 0 to 14. A pH value of 7 indicates a neutral substance, such as pure water. Values between 7 and 14 denote progressively greater alkalinity, and values between 7 and 0 denote progressively greater acidity. As you can see in figure 6-2, a change of one unit of pH value on the scale indicates a change of acidity or alkalinity of ten times. For example, a pH of 5 is ten times as acid as a pH of 6, and a pH of 0 is one million times as acid as a pH of 6.

There are several methods of determining the pH value of a solution: the electrometric, the colorimetric, and the test strip. The electrometric method is the most accurate, however it requires sophisticated equipment not normally found in the average lithographic print shop.

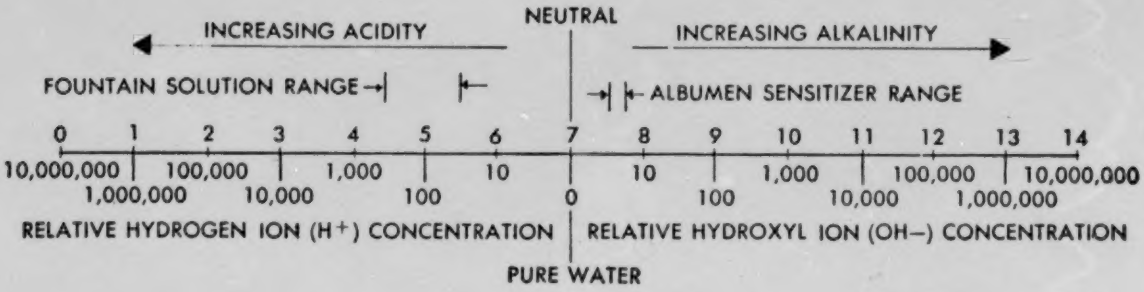
The colorimetric method requires that a measured portion of the solution being tested be mixed in a vial with a measured portion of dye. The resultant colored solution is then placed in a device called a comparator, where its color is matched to colored disks of predetermined pH values.

The most common way you will use, as a lithographer, to determine pH values of solutions is the test strip method. This method uses a chemically-treated paper strip which changes color when it is dipped into the solution being tested. As you can see in figure 6-3, the paper strip is obtained from a small plastic dispenser which includes a color chart that indicates pH values. By matching the color of the moistened test strip to the color chart, you obtain the pH reading of the solution being tested.

There are different ranges of dispensers to meet the varying requirements of the pressroom and platemaking departments of a lithographic print shop.

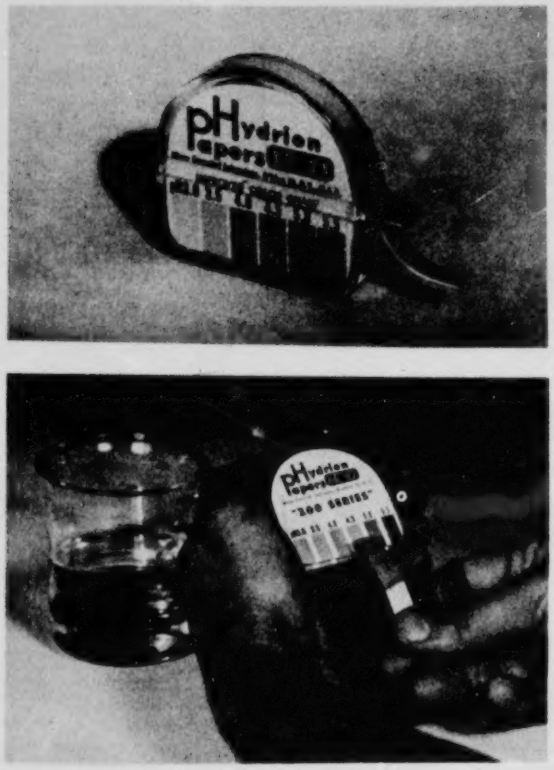
CHEMISTRY OF PHOTOGRAPHIC EMULSIONS

Photographic emulsions consist of minute particles of a silver halide suspended in gelatin. It is the silver halide that is light-sensitive; the gelatin simply holds the silver halide in suspension and bonds it to the supporting base.


NEUTRAL
INCREASING ACIDITY
INCREASING ALKALINITY
FOUNTAIN SOLUTION RANGE
ALBUMEN SENSITIZER RANGE
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
10,000,000
1,000,000
100,000
10,000
1,000
100
10
0
10
100
1,000
10,000
100,000
1,000,000
10,000,000
RELATIVE HYDROGEN ION (H+) CONCENTRATION
RELATIVE HYDROXYL ION (OH–) CONCENTRATION
PURE WATER

57.101

Figure 6-2.—pH scale.


pHydrion Papers
"200 SERIES"

57.709X

Figute 6-3.—A paper tape testing dispenser (top). Reading the moistened test strip on the dispenser (below).

Silver halides are produced by dissolving bars of metallic silver in nitric acid. This creates silver nitrate and hydrogen gas. The silver nitrate is then combined with a solution of one of the metallic salts of the halogens. (A halogen is one of a family of elements which readily react with metals to form salts. Of the four halogens: bromine, chlorine, iodine, and fluorine, only the first three are of importance in photography.) When the silver nitrate is combined with sodium chloride, silver chloride is one of the resulting compounds; combination of silver nitrate and potassium bromide result in a silver bromide compound; and silver nitrate and potassium iodide result in silver iodide. These are known as silver halides. They are insoluble in water.

Of the silver halides, silver bromide is most sensitive to light and silver iodide is least sensitive, with silver chloride in between. Combinations of two or three of the silver halides may be used to produce emulsions of varying sensitivities.

Gelatin is made by boiling animal tissues. It is one of a group of organic substances known as colloids. When colloidal materials absorb water, they become glue-like, and they dry to a semi-solid.

Refined gelatin is mixed with the halide solution (sodium chloride, potassium bromide, etc.). Then the silver nitrate solution is added to form the silver halide crystals. The size of the crystals depends upon the speed at which the silver nitrate is added. The slower it is added, the larger the crystals. Size also depends upon the temperature of the solutions. The lower the temperature, the smaller the crystals. As the silver halide crystals are formed, the emulsion becomes light-sensitive, and it must then be handled in the dark or in specially controlled light (safelight).

After thorough mixing, the emulsion is cooled. The gelled emulsion is shredded and washed and then "ripened" with ammonia fumes and heat. This ripening process causes some of the silver halide particles to unite and form larger crystals. This makes the emulsion more sensitive, since the light travels faster when it is unhampered by a mass of finely divided particles. Light first enters the emulsion at a point where slight irregularities exist along the surface, and, if given enough time, works its way right down to the film base. Large crystals facilitate passage of light and smaller ones retard it. This is why faster films are often relatively grainy.

After the ripening, the gelled emulsion is again liquified. It is then flowed onto a supporting base, such as glass, paper, or various plastics. After this, it is allowed to cool. As it cools, the emulsion forms a smooth, hard, flexible, surface. Another thin layer of gelatin is then flowed over the emulsion to form a protective coating.

PHOTOGRAPHIC BASES

You have just seen that glass, paper and various plastics may be used as the base or support for the photographic emulsion. A good base must not shrink or stretch to excess. All materials used as photographic bases vary somewhat with changes in temperature, but glass varies least. All materials, except glass, vary also with changes in humidity. For these reasons, glass plates are sometimes used for negatives and positives in map and chart work, and in precision color work, where extreme close register is required. The use of glass is limited, however, because of its weight, bulk, fragility, and high cost. Moreover, recent improvements in the dimensional stability of film bases make it possible to use film for almost all close-register work. When properly handled, the low-shrink film bases are sufficiently stable for map and other close-register reproduction.

Glass Plates

Glass plates fall into two categories: dry and wet. Both types require special adapters in the camera back.

A dry plate is simply a piece of glass coated with a photographic emulsion. These plates are coated by the manufacturer and come packaged ready for use. They are often used for color separation and such fine-register work.

Wet plates are more involved than dry plates. The cameraman must coat the plate himself, and must expose it while it is still wet. They are used for some types of map and chart work because they are relatively easy to correct when changes are made or new material must be added.

Because of their limited use, and the disadvantages cited above, glass plates are not used in the Navy.

Paper Negatives

Photographic paper is used in making positive prints (snapshots) and enlargements. In addition, certain types of photographic papers are used for making negatives. Paper negatives with a translucent base, such as GAF Reprocopy or Kodalith Translucent Material are satisfactory for most line work. These papers are usually coated with the same emulsion as film and, if used properly, produce the same results at less cost. Paper negatives tend to stretch when wet, but are satisfactory in cases where minor size variations are not important.

Some paper negatives have a white, semi-opaque base which requires considerably longer exposure when printing the plate. The translucent negatives can be exposed for approximately the same length of time as film when the plate is printed.

Paper negatives are not recommended for halftone work due to the paper grain. This grain may cause a mottled effect when the halftone is printed on the plate.

Film

Photomechanical film consists of a base coated on one side with light-sensitive emulsion, and coated on the other side with a gelatin non-curl backing, to prevent curling as the film dries. The base is commonly cellulose triacetate, called acetate base. It is satisfactory for most uses. Some manufacturers produce a light plastic-base film which is adequate for line work requiring minimal stability. These films are used much the same as paper negatives. The recently developed polystyrene and polyester base films (known by such trade names as Cronar, Ester, Gafstar, etc.) are used where dimensional stability is required.

The manufacturer generally places a coating of dye between the emulsion and the film base to prevent internal reflection. This dye, known as the anti-halation backing, absorbs the light after it passes through the emulsion and prevents it from striking the base and reflecting back to other areas of the emulsion, as shown in figure 6-4. This dye dissolves during processing operations.

Film thicknesses range from .003" (thin base), through .005" (regular base) to .007" and .015" (thick base). Regular base film is generally used for normal work; thin base may be used for special contact situations; and thick base film may be used if additional stability is required. A special kind of film, stripping film, is used in some shops for combination and close-contact work. After a few minutes in warm water, the emulsion soaks loose from the film backing and can be stripped onto a sheet of glass or other backing in combination with other negatives.

Although film is available in rolls, most shops use cut or sheet film. Most sheet film is notched in one corner. The notch shows the type of film and helps you to determine the emulsion side when you are in the darkroom. When you hold the film with the notch at the top and right, the emulsion will be facing you. Some large sheets simply have the entire corner cut, as shown in figure 6-5. Some blue-sensitive and orthochromatic films are not notched because you can determine the emulsion side readily by looking at the film in safelight. Under safelights, the emulsion side of a sheet of film appears dull compared to the non-emulsion side.

FILM EMULSIONS

As you have seen, the preparation of photographic emulsions is the result of a number of variables. These variable factors are rigidly controlled by the manufacturer to produce a wide range of emulsion characteristics, such as color sensitivity, contrast, and speed.

Color Sensitivity

When the human eye views an object, it registers two distinct sensations: difference in brightness and difference in color. Film used in black-and-white photography registers only differences in brightness. Color differences are translated into brightness differences. The ability to translate colors into shades of gray on the film is known as the color sensitivity of the emulsion.

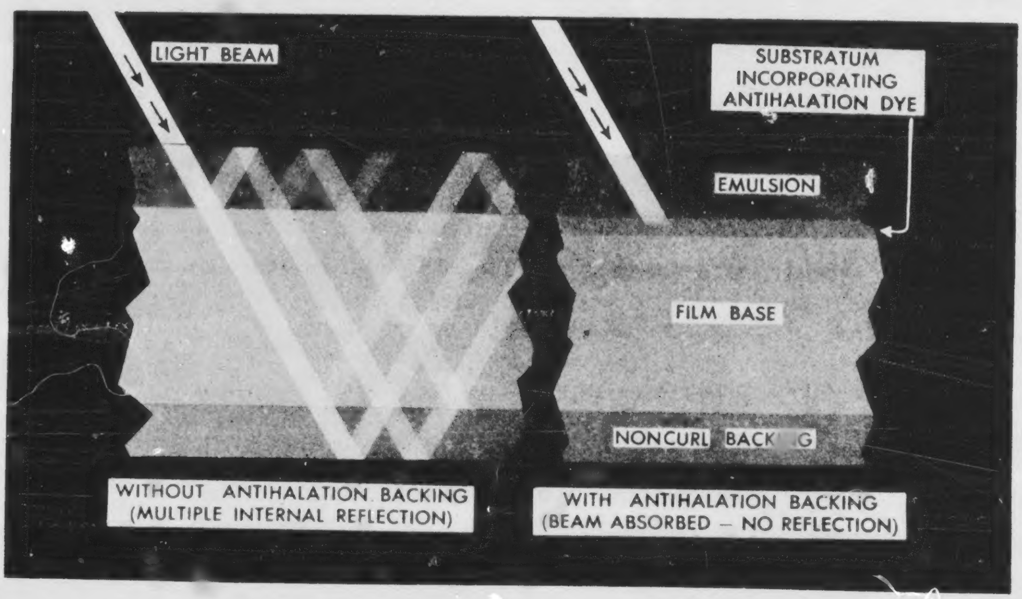
The normal sensitivity of photographic emulsions is limited to the blue region (blue, blue-violet, and ultra-violet) of the spectrum. Such emulsions are known as regular, blue-violet, and ultra-violet) of the spectrum. Such emulsions are known as regular, blue-sensitive, or color-blind film. They are insensitive to the green and red portions of the spectrum. These films register blues as dark grays on the negative and light grays on the print; all other colors register as light grays on the negative. Color-blind films are used for black-and-white copying only, or for making contact positives from other negatives.

By adding certain sensitizing dyes to the emulsion, the normal sensitivity may be extended to other regions of the spectrum. One type of dye will render the emulsion sensitive to the green and yellow regions as well as the blue. This emulsion is known as "orthochromatic", meaning "straight color", which refers to this emulsion's ability to give a truer rendition of color. Orthochromatic, or ortho, films are used for single-color subjects, or those which do not require red rendition.

Other dyes can be added to extend the range of sensitivity into the orange and red regions of the spectrum. Such films are known as "panchromatic" emulsions, meaning they are sensitive to "all color". Panchromatic, or pan, emulsions are used when all colors are to be reproduced, as in color separation work.

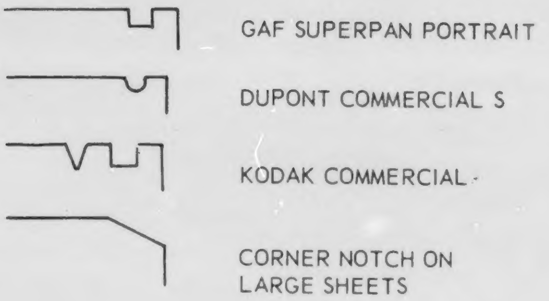
The diagram in figure 6-6 shows the relative sensitivity of blue-sensitive, ortho and pan emulsions as compared with the sensitivity of the normal human eye.

Color sensitivity also depends upon the light source used in exposing the film. Carbon arc lamps give off a high percentage of blue light, and tungsten lamps give off a greater percentage of red light. For this reason, exposures to arc


LIGHT BEAM
SUBSTRATUM INCORPORATING ANTIHALATION DYE
EMULSION
FILM BASE
NONCURL BACK[illegible]G
WITHOUT ANTIHALATION BACKING (MULTIPLE INTERNAL REFLECTION)
WITH ANTIHALATION BACKING (BEAM ABSORBED – NO REFLECTION)

57.103

Figure 6-4.—Halation through film.


GAF SUPERPAN PORTRAIT
DUPONT COMMERCIAL S
KODAK COMMERCIAL
CORNER NOTCH ON LARGE SHEETS

57.104

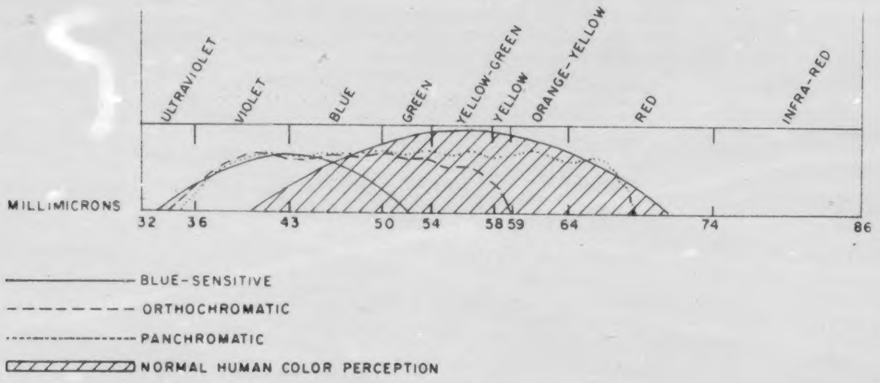
Figure 6-5.—Sheet film reference notches. The notches are different on each type of film.

lamps are usually shorter than those to tungsten lamps, especially when ortho films are used. Quartz-iodine lamps have color characteristics similar to tungsten lamps. Pulsed xenon lamps are similar to arc lamps but have some excess red/infra-red radiation.

Contrast

The blackness (density) of the silver deposits on the film directly affect the amount of light that can pass through it. Naturally, more light is transmitted through the gray areas than through the blacker, denser areas of the negative. The difference in densities of the various areas of the negative is called contrast. Normal contrast is represented by a full range of densities from dense blacks, through intermediate grays, to transparent, open areas. High contrast negatives do not have a full range of densities; they consist of dense blacks and transparent areas only. Low contrast negatives have very little difference in densities; everything is rendered as a medium gray.

Films used in regular photography (snapshots, for instance), are generally normal contrast films, and are said to be long scale films, because they can record a wide range of tones. The high contrast films, such as those used in lithography, are said to be short scale films, because they record only a very narrow range of tones.



57.105

Figure 6-6.—Relative color sensitivity.

Kinds of Film

There are many kinds of film, but you will be concerned only with those used for copying and reproduction purposes. In your work, you will be dealing with photomechanical (process) film for most work; although you may have some occasion to work with continuous-tone films. Both types are similar in general composition and properties. They vary primarily in contrast, and also in relative sensitivity and grain size.

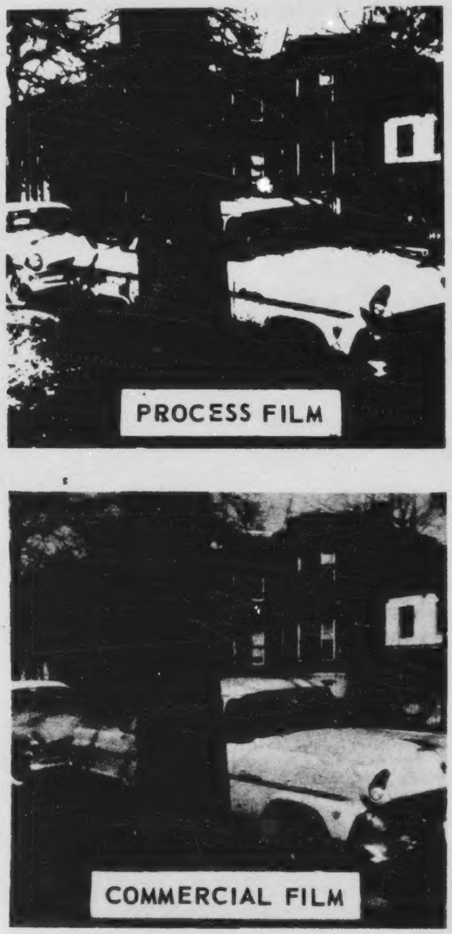
Continuous-tone films are used for general photography, such as the snapshots you might take with your personal camera. These films are used because they have a wide range of tonal values. Process films are used chiefly for line and halftone work. They are so contrasty that they form sharp, abrupt breaks between light and dark areas, and intermediate gray areas either register as black or drop out entirely. For this reason, they are not suitable for continuous-tone work.

Take a look at the top illustration in figure 6-7. It was shot with process film. Notice how clear the lettering appears; yet the photo is a mere black-and-white skeleton. All the light gray details have been lost, and the dark grays have merged with the black. This results in the loss of important details in both highlight and shadow areas.

Now look at the bottom illustration, which was made with a continuous-tone film. This film has a long scale and reproduces more faithfully the actual tones of the original. Notice that the details of the photograph are reproduced in various shades of gray, much as the original, and also that the lettering has lost the contrast that was present in the photograph above.

From this, you might draw the conclusion that lettering or line work should be copied with process film and all tone work should be copied with continuous-tone film. This is true if regular photographic prints are to be made from the negatives, but a different procedure must be followed if the job is to be printed on the offset press.

The offset press transfers a solid layer of ink to the paper; it can produce only solid blacks and whites. It is the image on the plate which determines whether an area will print light or dark. To reproduce the subtle gray tones in photographs or other continuous-tone copy (such as a sketch in pastel chalks), the cameraman must shoot the copy through a halftone screen. The screen, as you have seen, breaks up the image into a series of small dots of varying sizes. Strong light reflections from the light areas (highlights) of the copy pass through the openings in the screen and fan out to produce large black dots on the negative. Weaker reflections



57.106
Figure 6-7.—Comparison of work copies with process film, above; and with continuous-tone (commercial) film, below.

from the dark areas (shadows) or gray areas (middletones) form smaller dots. When the film is developed, the image consists of a series of dots which vary in size according to the brightness of the original copy. When the plate is made from this negative and run on the press, the dots print as tiny black solids. Since the dots are so small, they blend together to give the impression of a continuous tone. Areas where the dots are large look darker than areas where the dots are small with more white space between them, because the eye mixes the white space with the black dots and subdues the color, giving a gray tone. The varying sizes of the dots thus produce graduated tones like those found in the original.

Process film is used for both line and halftone negatives because high contrast is required to produce printing images that have sharply defined printing areas. Figure 6-8 shows a comparison of prints made with continuous-tone, line, and halftone negatives.

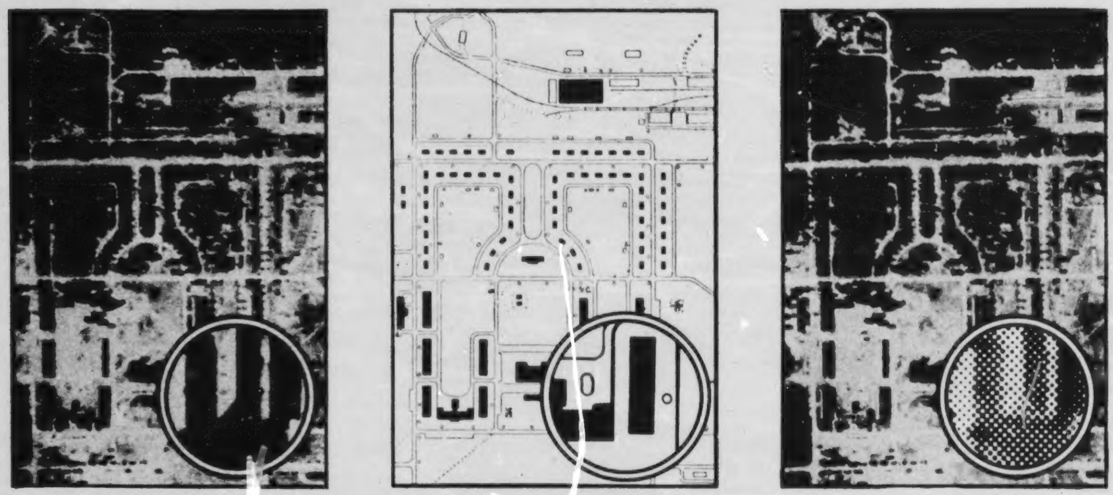
Each type of film has its own particular purpose and is at its best only when used for the purpose intended. In an emergency, you may substitute one type of film for another, but, if you do, you must make compensations during processing. For example, if you use a continuous-tone film for line or halftone work, you must develop it to the fullest. On the other hand, if you use process film for continuous-tone work, you must dilute your developer (generally 4 to 6 parts of water to 1 part of developer) to soften the development.

Most film manufacturers include a film data sheet in each box of film. This data sheet provides information on recommended exposures, processing instructions, and other pertinent facts regarding the characteristics of their particular film. Figure 6-9 illustrates a data sheet for Kodalith orthochromatic film.

In addition to the film date sheet, information on photographic materials can be found in the *Photo-Lab-Index*. This reference manual is published by Morgan & Morgan, Inc. of New York. It is recognized as the "bible" of photographic information. A copy of this manual should be available to you from your activity's photo lab.

Speed

The speed (sensitivity to light) of an emulsion is an indication of the amount of light required to produce a satisfactory negative. You have already seen that faster film is more grainy than slower film. Most process film is slow and very contrasty. The grain of this film must be very fine to reproduce thin lines of the copy and fine halftone dots with sharpness. The film's ability to reproduce thin lines is known as its resolving power, and is expressed in lines per millimeter.



CONTINUOUS TONE LINE HALFTONE

57.107

Figure 6-[illegible].—Comparison of prints from continuous-tone, line, and halftone negatives.

Since there is ordinarily no movement during copying, the speed of the film is of relatively little importance.

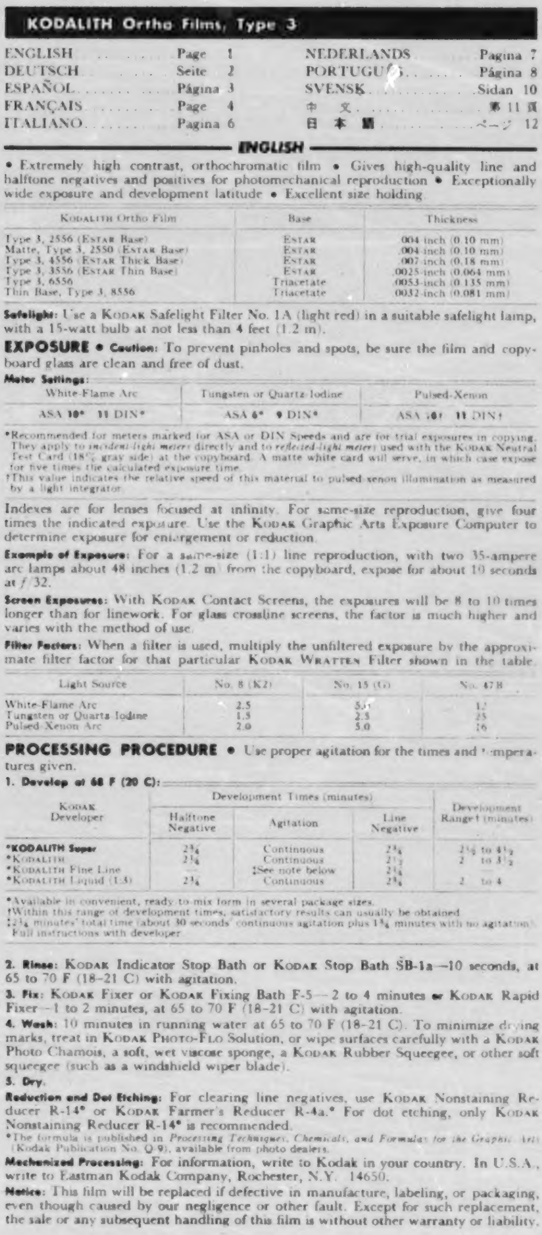
Of course, some emulsions are fast and others are slow, so it is necessary to have some system which shows how the speed of one film compares with that of another. The American Standards Association has adopted a method of measuring and expressing emulsion speeds. This method is recognized by manufacturers of films, exposure meters, and flashbulbs and other illuminants. This rating is known as the ASA Exposure Index. It is a numerical value assigned to the film for use in conjunction with exposure meters, guides, and other devices to assist in computing correct exposure time.

The ASA Exposure Index begins at 0 (no sensitivity) and runs to 1000 and higher for very fast emulsions. For example, Dupont Commercial-S film has an index of 50, and XF-Pan has an index of 125, indicating that the XF-Pan is 2 1/2 times as fast an emulsion as the Commercial-S. A recently developed Kodak film (Kodak 2485 High Speed Recording Film) has an ASA Exposure Index of 8000, but such an extremely fast film would not be used in lithographic work. Since process films are relatively slow, the exposure index for these films generally ranges from ASA 6 to ASA 40.

Most shops use one general-purpose film, and the exposure index for this film is used as the basis for the exposure of all other films. For example, if the exposure index of your general-purpose film is 4, and it normally takes 30 seconds to make a same-size line shot at f/32, you would cut the exposure time in half if you switched to a film with an exposure index of 8.

Types of Exposures

You have already seen that the color sensitivity is affected by the type of lighting used. Such differences in color sensitivity also affect exposure time. Daylight contains a large quantity of blue light, while tungsten light is predominantly red. For this reason, it is necessary to assign two different exposure indexes—one for daylight and one for tungsten. All films have a higher index for daylight than for tungsten due to the smaller percentage of blue-violet color in the artificial light. The difference is less for panchromatic film because this film is sensitive



KODALITH Ortho Films, Type 3

ENGLISH	Page 1	NEDERLANDS	Pagina 7
DEUTSCH	Seite 2	PORTUGUÊS	Página 8
ESPAÑOL	Página 3	SVENSK	Sidan 10
FRANÇAIS	Page 4	中 文	第 11 頁
ITALIANO	Pagina 6	日 本 語	ページ 12

ENGLISH

• Extremely high contrast, orthochromatic film • Gives high-quality line and halftone negatives and positives for photomechanical reproduction • Exceptionally wide exposure and development latitude • Excellent size holding

KODALITH Ortho Film	Base	Thickness
Type 3, 2556 (ESTAR Base)	ESTAR	.004-inch (0.10 mm)
Matte, Type 3, 2550 (ESTAR Base)	ESTAR	.004-inch (0.10 mm)
Type 3, 4556 (ESTAR Thick Base)	ESTAR	.007-inch (0.18 mm)
Type 3, 3556 (ESTAR Thin Base)	ESTAR	.0025-inch (0.064 mm)
Type 3, 6556	Triacetate	.0053-inch (0.135 mm)
Thin Base, Type 3, 8556	Triacetate	.0032-inch (0.081 mm)

Safelight: Use a KODAK Safelight Filter No. 1A (light red) in a suitable safelight lamp, with a 15-watt bulb at not less than 4 feet (1.2 m).

EXPOSURE • **Caution:** To prevent pinholes and spots, be sure the film and copyboard glass are clean and free of dust.

Meter Settings:

White-Flame Arc	Tungsten or Quartz-Iodine	Pulsed-Xenon
ASA 10* 11 DIN*	ASA 6* 9 DIN*	ASA 10† 11 DIN†

*Recommended for meters marked for ASA or DIN Speeds and are for trial exposures in copying. They apply to *incident-light meters* directly and to *reflected-light meters* used with the KODAK Neutral Test Card (18% gray side) at the copyboard. A matte white card will serve, in which case expose for five times the calculated exposure time.

†This value indicates the relative speed of this material to pulsed-xenon illumination as measured by a light integrator.

Indexes are for lenses focused at infinity. For same-size reproduction, give four times the indicated exposure. Use the KODAK Graphic Arts Exposure Computer to determine exposure for enlargement or reduction.

Example of Exposure: For a same-size (1:1) line reproduction, with two 35-ampere arc lamps about 48 inches (1.2 m) from the copyboard, expose for about 10 seconds at *f*/32.

Screen Exposures: With KODAK Contact Screens, the exposures will be 8 to 10 times longer than for linework. For glass crossline screens, the factor is much higher and varies with the method of use.

Filter Factors: When a filter is used, multiply the unfiltered exposure by the approximate filter factor for that particular KODAK WRATTEN Filter shown in the table.

Light Source	No. 8 (K2)	No. 15 (G)	No. 47B
White-Flame Arc	2.5	5.0	12
Tungsten or Quartz-Iodine	1.5	2.5	25
Pulsed-Xenon Arc	2.0	5.0	16

PROCESSING PROCEDURE • Use proper agitation for the times and temperatures given.

1. Develop at 68 F (20 C):

KODAK Developer	Development Times (minutes)			Development Range† (minutes)
	Halftone Negative	Agitation	Line Negative	
***KODALITH Super**	2¾	Continuous	2¾	2½ to 4½
*KODALITH	2¼	Continuous	2½	2 to 3½
*KODALITH Fine Line	—	‡See note below	2¼	—
*KODALITH Liquid (1:3)	2¾	Continuous	2¾	2 to 4

*Available in convenient, ready-to-mix form in several package sizes.

†Within this range of development times, satisfactory results can usually be obtained.

‡2¼ minutes' total time (about 30 seconds' continuous agitation plus 1¾ minutes with no agitation). Full instructions with developer.

2. Rinse: KODAK Indicator Stop Bath or KODAK Stop Bath SB-1a—10 seconds, at 65 to 70 F (18–21 C) with agitation.

3. Fix: KODAK Fixer or KODAK Fixing Bath F-5—2 to 4 minutes or KODAK Rapid Fixer—1 to 2 minutes, at 65 to 70 F (18–21 C) with agitation.

4. Wash: 10 minutes in running water at 65 to 70 F (18–21 C). To minimize drying marks, treat in KODAK PHOTO-FLO Solution, or wipe surfaces carefully with a KODAK Photo Chamois, a soft, wet viscose sponge, a KODAK Rubber Squeegee, or other soft squeegee (such as a windshield wiper blade).

5. Dry.

Reduction and Dot Etching: For clearing line negatives, use KODAK Nonstaining Reducer R-14* or KODAK Farmer's Reducer R-4a.* For dot etching, only KODAK Nonstaining Reducer R-14* is recommended.

*The formula is published in *Processing Techniques, Chemicals, and Formulas for the Graphic Arts* (Kodak Publication No. Q-9), available from photo dealers.

Mechanized Processing: For information, write to Kodak in your country. In U.S.A., write to Eastman Kodak Company, Rochester, N.Y. 14650.

Notice: This film will be replaced if defective in manufacture, labeling, or packaging, even though caused by our negligence or other fault. Except for such replacement, the sale or any subsequent handling of this film is without other warranty or liability.

57.710X

Figure 6-9.—A film data sheet.

to all colors ~~and can~~ utilize the yellow and red radiation which forms the greater portion of most artificial light. Film manufacturers may also assign a separate index for carbon-arc lighting. However, carbon-arc lighting closely resembles daylight in its color characteristics, and the daylight exposure indexes are generally used.

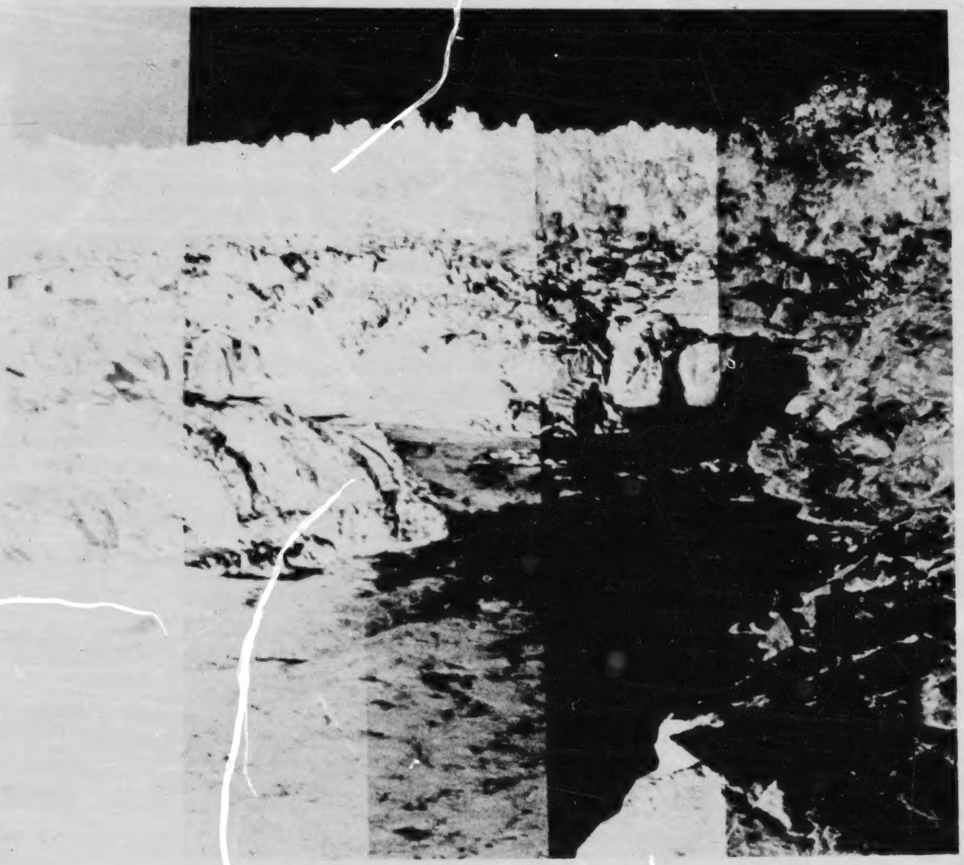
Many shops prepare a table showing approximate exposure times for each type of film used in their particular setup. This table generally takes into consideration different types of copy and percentages of reduction and enlargement required. You may follow the table for the average work. For different films or with out-of-the-ordinary work, you should determine your exposures with a series of test exposures.

You can make a series of test exposures on a strip of film. To do this, use black paper to mask off the copy so that one area at a time will be exposed, or, if you have access to the camera back, you can mask off the film with black paper. As an example, you may expose the first area for 6 seconds; then expose the second area for 8 seconds. Expose the other areas for 11, 15, 20 and 27 seconds, or at some other convenient intervals. After processing according to the manufacturer's instructions, examination will show which was the proper exposure. An example of a test exposure is shown in figure 6-10.

Characteristic Curves

Film manufacturers make a series of exposures on a particular film and then measure the densities of the developed strips and plot them on a graph against the logarithms of the exposure times used in producing them. By plotting the densities against the log exposure times, they come up with a curve something like that shown in figure 6-11. This curve is known as the characteristic curve because it shows the properties peculiar to that emulsion.

The foot of the curve represents the shadow areas of the negative, the shoulder represents the highlight areas, and the straight-line portion represents the gray, middletone areas. The slope of the straight-line portion shows the degree of contrast it is possible to attain in developing the film. This slope can be measured by a mathematical formula and assigned a numerical value, known as gamma (the Greek letter γ). If this



57.109

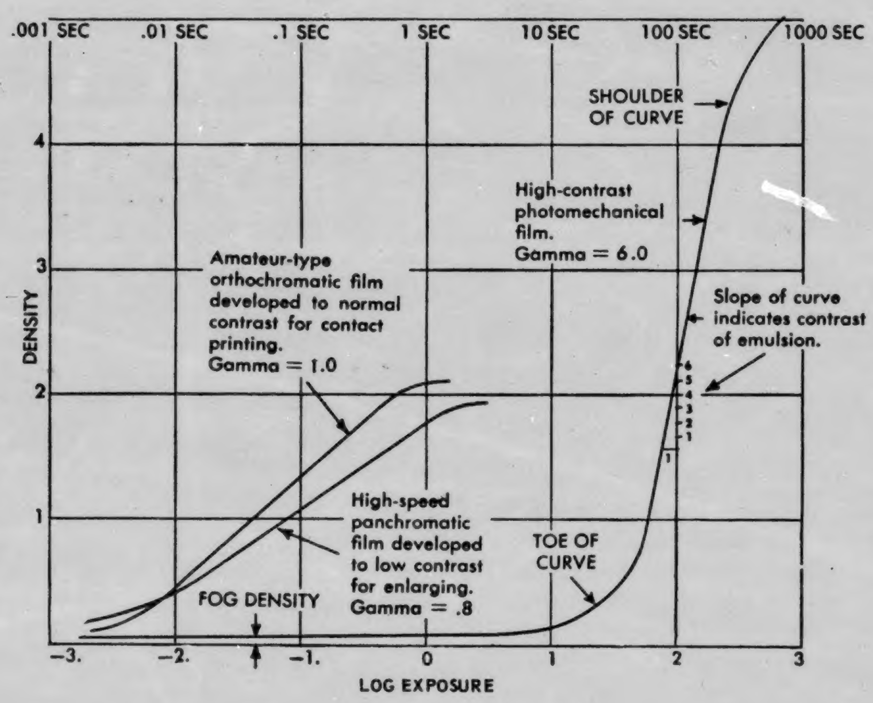
Figure 6-10.—Results of six separate exposures on the same negative.

slope is at a 45° angle, for example, the increase in density is directly proportional to the increase in exposure, and the contrast of the negative is the same as that of the original. If the slope is steeper, the contrast of the film is greater. Most process films can be developed to a high contrast (gamma 3.0 to 10.0, indicating that the contrast is 3 to 10 times that of the original). Continuous-tone films, on the other hand, may develop to approximately the same contrast as the original (gamma 1.0). The gamma, or developing contrast, builds as long as the film is left in the developer, until it finally reaches a point where it levels off. Later in this chapter you will learn how to develop negatives to a desired contrast by the use of time-temperature development charts.

PROCESSING THE FILM

As you have already seen, when the sensitized emulsion is exposed to light, the light acts on the silver halide particles to form an image. This image is invisible, and is called a latent image. The latent image can be converted to a visible image by the action of certain chemicals. This process is called developing.

When the exposed film is placed in the developer, the unexposed silver halide particles



57.110

Figure 6-11.—Characteristic curves for negative emulsions made by plotting negative density against log exposure time. The characteristic curve for photomechanical film has a very steep slope because process films are very contrasty. Continuous-tone films are less contrasty and the slope of their characteristic curves are not as steep. It is necessary to use logarithms of exposure times because the densities are actually a logarithm (to the base of 10) of the opacity of the negative. This means that density 1 represents an opacity 10 times greater than density 0. Similarly, a log exposure of 1 represents 10 seconds; log exposure 2 represents 100 seconds, and so on. Log exposure −1 represents 1/10th second; log exposure −2 represents 1/100th second, and so on.

are not changed, but the exposed particles are chemically reduced (oxidized) to form black metallic silver. This produces a visible image on the film.

Following development, the film is washed and then transferred to another solution which removes the unexposed silver halides to prevent further action by light. This portion of the film processing is known as fixing.

Developer

Developing solutions are composed of a number of chemical agents. Each plays an important role in the reduction of the exposed silver halides into metallic silver. When the film is placed in the developer, the solution penetrates into the gelatin and starts the reduction. As development continues, the metallic silver becomes darker, and contrast increases. If the development continues too long, the unexposed silver halides may become oxidized and darken, or "fog". Different films require different developers, and different developers require different developing times to produce satisfactory negatives.

The developing agent, or reducer, is the most active ingredient in the developer. Many chemicals could be used as developing agents, but most of them are so powerful they would reduce all the silver halides in the emulsion, exposed and unexposed. A suitable reducer affects only the exposed particles of silver halide. It is chosen for its ability to convert the silver halide in the emulsion into metallic silver in proportion to the amount of light reaching the emulsion. The two most commonly used reducers are hydroquinone and p-methylaminophenol sulfate (which is known by the trade names Elon, Metol, Photol, Pictol, Rhodol, and Veritol). Hydroquinone is a strong reducer and produces a high contrast negative, like that required for lithographic work. Elon (and other such reducers) produce softer, low contrast negatives, such as are needed for continuous-tone work. Frequently, combinations of hydroquinone and Elon are used to vary the developing formulas.

Most developing agents are neutral or slightly acid when in solution. Since they do not work effectively in this condition, alkalies are added to speed up the development. The alkalies also swell the gelatin to permit rapid penetration of the reducer into the emulsion. Such chemicals as sodium carbonate, potassium hydroxide, and borax are used as accelerations. Sodium hydroxide and paraformaldehyde are frequently used accelerators in photomechanical (process) developers.

Some developers, especially those containing paraformaldehyde, require an ingredient to control the alkalinity of the solution. The most commonly used ingredient, called a buffer, is boric acid. The buffer also helps to keep the developer clear by reducing the precipitation of substances which would make the solution cloudy.

When in an alkaline solution, the reducers also react readily with the oxygen in the air, causing a deterioration of the developer. To lengthen the life of the developer, a preservative is added to slow the rate of oxidation. The preservative absorbs excess oxygen from the water and the surrounding air. Sodium sulfite is the most widely used preservative. In photomechanical developers, sodium bisulfite and potassium metabisulfite are frequently used. Since the preservative also increases development time, only enough should be added to provide a satisfactory working life to the developer.

A final ingredient in the developer is the restrainer, which retards the speed of development and inhibits fog. The usual restrainer is potassium bromide. Excess restrainer will cause slow development; too little restrainer will permit fogging of the clear areas of the negative.

With use, the activity of some of the ingredients of the developer will gradually decrease. The useful life of a developer is usually determined by the manufacturer and is published in data sheets. The useful life is affected by (1) the amount and type of film developed; (2) the ratio of exposed to unexposed film area; and (3) the age of the developing solution. It is standard practice to replace the developer before its useful life is exhausted.

Preparing the Developer

Recent developments in the manufacture of processing solutions for the graphic arts industry have made the mixing and preparation of solutions a simple process. The major chemical manufacturers now produce the stock solutions for photomechanical developers in liquid concentrate form. These concentrates are prepared for use in the darkroom by simply diluting them with water.

The developers you use for processing film are separated into two parts or stock solutions. These stock solutions are referred to as part A and part B. One part stock solution is mixed with three parts of water to obtain a working solution. For example, to mix sufficient developer for the average size developing tray, pour eight ounces of part A concentrate into a graduate and add 24 ounces of water. Pour this solution into the tray. Repeat the same procedure with part B. Avoid mixing the two parts together at full strength. This will cause rapid deterioration of the developer.

In the past, the stock solutions were only available in powdered form. To prepare the powdered developers, it was necessary to dissolve the stock solutions in water heated to 125° F. Because of the high temperature and the possibility of undissolved particles in the solutions, it was common practice to age the solutions for 24 hours before using them. The liquid concentrate solutions eliminate the aging period entirely. Once the stock solutions are mixed with water, they are ready for immediate use.

Ordinary tap water is generally not pure water. Some of the impurities may combine with chemicals in the developer to form new compounds which will reduce the efficiency of the developer. Distilled water is best for developers, and may even be required in some formulas, but tap water is usually suitable. Aboard ship, your best possible source of water is the ship's evaporators.

Since film manufacturers prepare their emulsions for use with a specific developer, you should try to use the developer recommended by the film manufacturer. For example, with DuPont film, you should use DuPont chemistry; with 3-M film, you should use 3-M chemistry, and so on.

Temperature

Although temperature has little effect on the film exposure, it has considerable influence on processing. The most satisfactory negatives are produced when the temperature of all processing solutions is kept at 68° F. This is the standard of the photographic industry.

At temperatures below 50° F, development stops entirely. On the other hand, high temperatures will cause the developer to become overactive. Overdevelopment, fogging, and fill-in may result. When temperatures are high, you must reduce the development time or dilute the solution. High temperatures also shorten the useful life of the developer.

At temperatures above 75° F, the emulsion will become excessively softened. Reticulation (breaking up of the emulsion) and frilling (separation of the emulsion from the base along the edges) may then occur. Reticulation, frilling, and blistering may also occur when temperatures of successive processing solutions vary to extremes.

As you have seen in chapter 5, temperature-controlled sinks are ideal for maintaining constant temperatures for processing solutions. If they are not available, you may be able to control the temperature by placing the trays containing processing solutions in a larger tray containing ice water or hot water, as required. Never put ice directly in the solutions, as the ice will melt and dilute them. When ice is not available, cold tap water may be used in the larger tray, or processing may be done in the early morning before temperatures start to rise.

At higher temperatures, the use of a prehardener (such as Kodak formula SH-5) before development will sufficiently harden the emulsion so that processing may be done at temperatures up to 110 °F. The formula for this prehardener and other valuable data on high-temperature problems may be found in the *Photo-Lab-Index*.

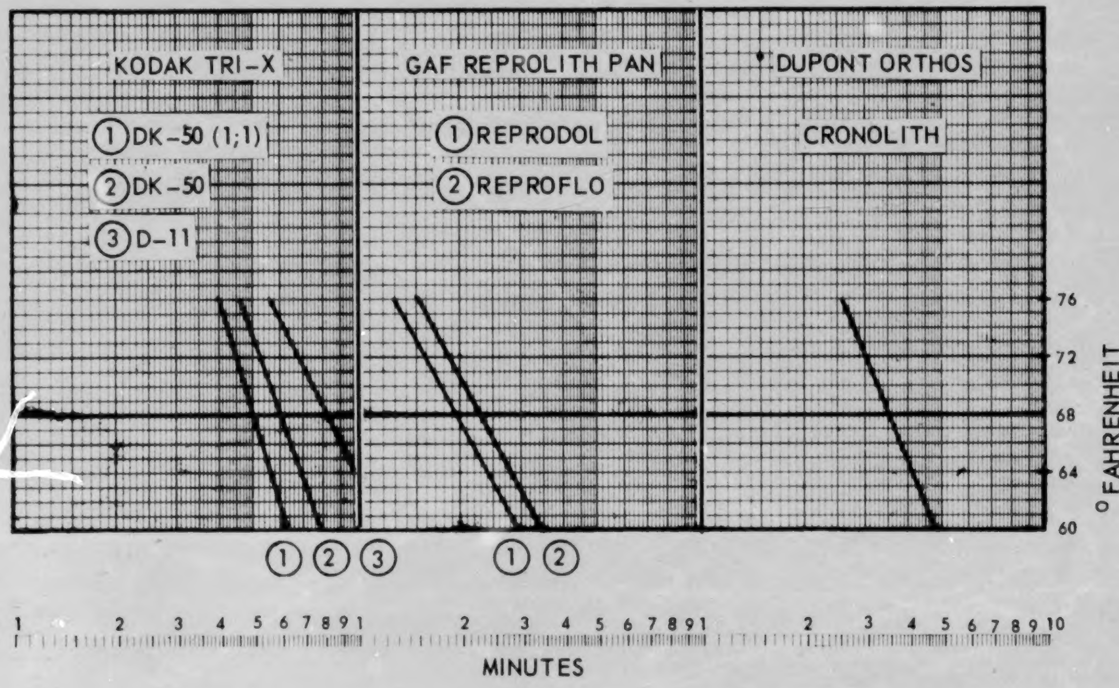
Developing Time

Because of the actinic action of light, the exposed portions of the film can be developed with less expenditure of chemical energy than the unexposed portions. Therefore, they develop readily—long before the chemicals start to reduce the unexposed silver halides. If the development is carried on too long, however, the developer will start to act on the unexposed portions and cause the unexposed areas to turn gray (fog).

Process films are generally developed from 2 to 5 minutes, depending upon the strength of the developer, its temperature, and the degree of contrast (gamma) desired. You can use a time-temperature chart, such as those shown in figure 6-12, to determine how long the film should be developed at a given temperature to produce a given contrast. A time-temperature chart is usually included with each package of film, or you may find it in the *Photo-Lab-Index*. If you have full control of the developing temperature (a properly operating temperature-controlled sink), the time-temperature method is the most consistent method of film processing. It allows you to control contrast variation without having to manipulate lens aperture, exposure time, or illumination.

Development by Inspection

Under conditions where the temperature cannot be fully controlled, you may develop film by inspection instead of a set time method. You should look at the film frequently until the image starts to form, and at 5- to 10-second



57.592

Figure 6-12.—Time-temperature development charts. Numbers along the side represent the temperature of the developer and those at the bottom indicate development time in minutes. The diagonal lines represent recommended contrast or gamma. The heavy horizontal line indicates the normal developer temperature of 68° F. As you can see, as the temperature increases, time of development decreases. When more than one developer is recommended for a particular film, the chart shows a separate diagonal line for each developer.

intervals thereafter. Total development time should be about four times that required for the image to first appear. For example, if the image begins to appear at 45 seconds, total time should be about 3 minutes.

Agitation of the Developer

Under normal conditions, the temperature of the developer at the top of the tray will be higher than that at the bottom of the tray. You should agitate the solution to equalize the temperature before the film is placed in the developer. It is also necessary to agitate the solution while the film is being developed. This removes the spent developer and developing by-products from the emulsion, and brings a fresh supply of developing solution to it. Most process films are developed with intermittent agitation. This requires constant motion of the film in the developer for the first 15 seconds and at 10 second intervals thereafter. You can do this by moving the film or by gently rocking the tray. Lack of agitation may cause film streaks. However, when using certain films, or when shooting extremely fine lines, process the film without agitation. This is known as still development.

Deterioration

Developing solutions will deteriorate upon exposure to air. Some film developers will decompose in a few hours. Whenever possible, schedule your work in the darkroom so that all the film processing will be completed within a reasonable length of time. If it is necessary to process film several hours after the solutions have been mixed, you may revive the developer by adding a small amount of fresh solution. To add fresh developer in this manner is termed replenishment.

Developers should not be used indefinitely. They should be replaced when they have decomposed to the extent that processing takes about twice as long as normal.

Short-Stop Bath

Transferring the film directly from the developer to the fixer may cause blistering of the emulsion. It will also shorten the life of the fixer, since the alkali in the developer will neutralize the acid in the fixing solution. For this reason, negatives are generally washed in plain water for 20-30 seconds after they are taken from the developer. This removes most of the developer which the negative would otherwise carry over to the fixer.

Instead of plain water, you may use a dilute solution of acetic acid and water between the developer and fixer. This is known as the short-stop bath because it instantly stops development by neutralizing the alkaline developer on the negative and prevents contamination of the fixer by the developer.

At this point, if the temperature is extremely high, you can place the film in a hardening solution. Rinse the negative and place it in the hardening bath for a few minutes before fixing.

Fixing Solution

The fixer dissolves all the undeveloped silver halides in the emulsion and clears the film to prevent further action by light. The fixing solution is generally referred to as "hypo", because the principal ingredient, sodium thiosulfate is also known as hyposulfite of soda or hypo.

Acetic acid, or another acid, is also used in the fixer to neutralize all the remaining alkaline developer carried over on the film. Sodium sulfite is included to prevent the hypo from being decomposed by the acid, and a hardening agent, such as potassium alum, is added to toughen, or "tan", the gelatin.

The fixer should be agitated frequently until the white, milky portions of the emulsion have cleared, and occasionally thereafter during the remainder of the fixing time. The length of fixing time is generally double that required to clear the unexposed portions of the film, and varies from 1 to 5 minutes, depending upon the type of film and the solutions used. When the negative has cleared, the film is no longer light-sensitive and may be freely inspected.

If you need the negative in a hurry, you can take it from the fixer as soon as it clears. The negative can be used without proper fixing, but you must return it to the fixing bath for complete fixing, then wash it thoroughly if it is to be saved for future use.

The life of the fixer is controlled by its ingredients, the conditions under which it is used, and the amount of developer carried over on the film. It should be discarded when it takes twice the normal time to fix the negative.

Washing

If the film is to be saved, it should be washed from 10 to 20 minutes (depending upon the temperature of the water) in an ample supply of running water after fixing. If the chemicals left by the fixing bath are not removed from the emulsion, they will cause brown stains and destroy the image by oxidation. Photographic paper and paper negatives should be washed 30 to 40 minutes since they are more porous and the chemicals are more difficult to remove. If the negative is not to be saved, a 1 or 2 minute wash is sufficient.

You may find that your ship is faced with the problem of excessive water consumption. Operational requirements may demand that you produce vast amounts of printed matter (with a proportional increase in photography) and the engineers may not be able to furnish the large amounts of fresh water required for prolonged photo processing. In such cases, it will be necessary to use sea water for washing negatives or paper prints. You should wash the materials for half the time recommended for fresh water washing, then wash another 5 minutes in fresh water. Some cameramen use chemical hypo removers in the wash when water is in short supply. These chemicals reduce the time required for washing.

As you have seen, temperatures above 75° F may cause reticulation, frilling or blistering. The same problems may result if there is great temperature variation between the successive processing solutions. These solutions should be kept at the same temperature during all stages of processing.

Drying

After washing the film, you may go over it with a soft sponge or squeegee to remove excess water before drying. An excellent soft rubber squeegee is a clean windshield wiper blade. You may treat all your negatives with a wetting agent, such as Kodak Photo-Flo, to prevent water spots. You can hang the film to dry in a warm, dry room or in a drying cabinet; or you may dry it in a commercial film drier. You should avoid using hot air driers (such as hair driers) as you may blister the film.

REDUCING

You have already seen that fog may set in if the film is developed too long. Fog may also be caused by old film, internal reflections in the lens, or a leak in the camera bellows. The presence of fog renders a negative unsatisfactory, since it is difficult to estimate the exact density of the fog and its influence on platemaking. Process negatives require dense black solids and clear, transparent open spaces. If thin lines fog or fill in, you will generally find it quicker and more efficient to make a new negative, but in an emergency, you can dissolve the unwanted silver in the image areas with a chemical solution, known as a reducer. Of course, when you dissolve the silver in the image areas, you will also dissolve some of the silver in the opaque areas. However, the opaque areas are generally so dense that a small amount of reduction will not appreciably alter their value.

A solution of potassium ferricyanide and sodium thiosulfate (hypo), known as Farmer's Reducer, is commonly used for the reduction of films and plates. The potassium ferricyanide unites with the silver on the negative to form silver ferricyanide, which in turn is dissolved by the hypo.

The negative may be placed in a tray of the solution, or you may apply the solution with a cotton swab for local reduction. The speed of the reducer depends on its concentration and the quantity of potassium ferricyanide in the solution. The formula given in Appendix II is adequate for normal use.

INTENSIFICATION

Intensification is just the opposite of reduction. Intensifiers increase the density of silver grains in the emulsion by adding compounds of the heavier metals, such as chromium or mercury. Solutions of potassium bromide and mercuric chloride, and sodium cyanide and silver nitrate (known as Monckhoven intensifier) are generally used for process negatives. This intensifier does not fog the film and tends to clear the transparent areas while adding density to the black areas of the negative.

To intensify the negative, you should first bleach the image with the potassium bromide/mercuric chloride solution. Then wash the negative and blacken it with the sodium cyanide/silver nitrate solution. As you have already seen, you should use great care when working with cyanide solutions.

Intensification isn't quite as practical as it sounds. Process negatives are seldom intensified, because it is quicker to make a new negative. Then, too, intensification is effective only when the negative is underdeveloped; underexposed negatives are almost unaffected. However, it may be necessary to use intensifiers if there is a film shortage.

> CAUTION: Cyanides are extremely poisonous. In contact with acids, they produce deadly hydrogen cyanide fumes. You should always use adequate ventilation. Never use acid-fixer solution as a substitute for the hypo solution in the formula.

PHOTOGRAPHIC PAPERS

Six grades of photographic papers are used for making contact prints. The emulsions are almost entirely silver chloride, and contact papers are often referred to as "chloride" papers.

Hard (contrasty) paper is required if the negative is thin and flat; medium grades of paper are used for normal negatives; and soft papers are used for contrasty negatives. Papers are generally graded by number, No. 0 being the softest and No. 5 the hardest or more contrasty.

Enlarging papers are faster than contact papers. Their emulsions are primarily silver bromide. These papers are available in five grades of contrast. The hardest paper, No. 5, is used for extremely flat, thin negatives; medium contrast, No. 3, for normal negatives; and the softest, No. 1, for contrasty negatives.

Variable contrast enlarging papers are also available. These papers are coated with an emulsion whose contrast depends on the color of the light source used during the exposure. For example, if the paper is exposed with blue light it renders a very hard or contrasty image; and if it is exposed with green light, the same paper produces a very soft image. Therefore, it is possible by using a series of colored filters to duplicate on one grade of paper a range of contrasts that normally would require several different grades of enlarging paper.

When making photographic prints, do not try to control contrast by manipulating development time. It is always better to select the proper paper according to the type of negative and to control the contrast by varying the exposure.

Photographic prints are processed much the same as film. As with film, you will achieve better results if you use the developer recommended by the manufacturer of the paper. Instructions for mixing and developing are usually contained on or with each package of developer. Kodak D-72 (Dektol) is often used for photographic prints as well as for continuous-tone film. The formula may be found in Appendix II.

DUPLICATING AND AUTOPOSITIVE FILMS

The majority of your work in the darkroom requires that you use the standard photomechanical films. As you know, the photographic image produced on these films is the opposite of the original. A black-on-white image (positive) produces a white-on-black image (negative).

There are other types of films which have applications in the lithographers' darkroom. Duplicating film and autopositive film are two of these. With duplicating film, you can obtain a negative directly from a negative or a positive from a positive. The same is true of autopositive film, however, with autopositive material you also have the capability to produce a combination (negative and positive) image on the same piece of film.

Duplicating film must be handled in the darkroom under either light red or yellow safelights. Processing of duplicating film is similar to other photomechanical films.

Autopositive films are handled in ordinary light. Exposure to white light increases the density of autopositive film. To remove density, that is, to clear the film, a yellow light exposure is made. Autopositive film is processed in the conventional manner.

For detailed instructions and applications of autopositive and duplicating films read the various guides and data sheets available from film manufacturers.

SAFETY PRECAUTIONS

Many of the chemicals used in photographic work are skin irritants and others may cause serious injuries. Although not all photographic chemicals are poisonous, they should be treated as such and handled with caution.

Both strong acids and alkalies will cause severe skin burns. If a strong acid comes in contact with your skin, wash the place immediately with plenty of water, then neutralize the acid with bicarbonate of sode (baking soda) or some other weak alkali. Report to sickbay. Strong alkalies should also be washed off in water, then neutralized with a weak acid, such as well-diluted acetic acid (vinegar). The acid should, in turn, be washed off with plenty of water.

Some chemicals release poisonous vapors and should be handled only in rooms having adequate ventilation. Carbon tetrachloride is extremely toxic, and its use is prohibited aboard ship. Benzol, formaldehyde, wood alcohol, ammonium hydroxide, and leaded gasoline are also toxic. Nitric acid in contact with wood or other organic materials releases deadly vapors. Fumes released when cyanides are contacted by acids are extremely dangerous.

Some chemicals attack or corrode the trays, tanks or sinks in which they are stored or handled. Utensils used to contain solutions should be rinsed out carefully with water when the solutions are emptied. Strong acids or alkalies should be stored in recommended receptacles only. Always add acids to water gradually.

Before disposing of any photographic solutions, you should check with the engineering or public works personnel at your activity to insure that you are complying with the Navy's latest anti-pollution regulations. It may be necessary to make special provisions for your shop's chemical waste disposal because of the reactions which occur on some fittings and gaskets in certain types of waste systems.

Be sure to report to the medical officer any skin eruptions or irritations as soon as they appear.

Be suspicious of large batches of film that seem to have been exposed. This could be due to radiation. X-rays used by yard workers or ship's force to check welds, and so on, are particularly destructive to emulsions. You should make it your business to know where and when x-rays will be used during your yard period.

Although today's Lithographer deals mainly with commercially mixed chemicals and does not have to deal with bulk chemicals, the danger of personal injury is still there and knowledge of the do's and dont's is a must for safety. The following is a list of safety practices which must always be observed.

Do maintain scrupulous housekeeping practices in all areas where checmicals are used.

Do wash hands with an acid neutralizing-type hand cleaner and rinse thoroughly with water immediately after handling chemicals and several times a day when using chemicals.

Do impress all personnel with the importance of avoiding skin contact with chemicals or chemically contaminated surfaces.

Do store all chemicals in cool, dry, dark spaces. Separate storage areas should be maintained for chemicals which react violently with each other, to diminish the danger of fire or explosion. For example; do not store potassium permanganate near glycerin or cyanides near acids.

Do take every precaution when handling acid and caustic chemicals so they will not come in contact with the skin. These chemicals, when in contact with certain other materials, will heat until they are hot enough to start fires. In addition, strong acids give off toxic fumes which should not be inhaled.

Do not underestimate glacial acetic acid. This is one of the most dangerous chemicals handled in the darkroom. It is a fire hazard, an explosive hazard, causes serious burns, and yet is sometimes handled carelessly. This carelessness is due to moficiation of its hazardous aspects by dilution. Because it is used in weak solutions, many fail to be impressed with its dangerous potentials in concentrated form. It is also very dangerous in contact with chromic acid (photographic tray cleaner), sodium peroxide, or nitric acid.

Do not handle this acid in a confined space. Always insure plenty of ventilation. Acetic acid fires can be extinguished with water spray or fog, with carbon dioxide, dry chemical (sodium bicarbonate) foam, or other blanketing or smothering type of extinguisher.

Do not procure acetic acid stronger than 28 per cent concentration.

Do remember that acetic acid freezes at 60° F. Always insure protection against this.

Do not underestimate hydrogen peroxide. The use of 3 per cent hydrogen peroxide as a hypo eliminator is comparatively safe, but the increased uses of this chemical have resulted in its sale in concentrations of 30 to 70 per cent solutions. Hydrogen peroxide in these strengths is a dangerous fire hazard, as well as a dangerously corrosive agent if it touches the skin or eyes. When heated, shocked, or contaminated with catalytic decomposition agents such as metals and their salts, dusts, and alkalies, hydrogen peroxide is highly explosive and constitutes a disaster hazard. Never, under any condition, procure this chemical in strengths greater than

30 per cent and do not use a 30 per cent solution even in attached chemical control laboratories. unless it can be handled properly.

Do not add water to acid, always add acid to water. If water is added to the acid, it may cause the acid to generate a sudden heat sufficient to cause the solution to boil and splatter on you.

Do not mix photographic chemicals in thick glass containers; use Pyrex glass containers. Rapid temperature changes generated by chemicals in reaction cause regular glass containers to break more easily than thinner Pyrex containers, whose characteristics of viscosity or elasticity react to thermal expansion or contraction with less danger of breakage.

Do not mix an acid and a cyanide; this mixture produces a lethal gas.

Do always use cool water for dissolving strong alkalies such as sodium hydroxide or potassium hydroxide.

Do wash down promptly any spills of chemical solutions or liquid chemicals.

Do not place acids diluted with water into steel containers, because acids in dilution attack steel rapidly. Concentrated acid can be stored in steel drums and cans because it will not attack steel.

Do not store photographic chemicals unless containers are plainly marked as to content.

Do make the shelves sufficiently sturdy for the storage of photographic chemicals and provide them with suitable guard rails to prevent the chemicals from sliding, rolling, or falling off the shelves.

Do not start siphoning action when transferring chemical solutions through tubing by sucking on the exposed end of the tube.

CHAPTER 7

THE LINE NEGATIVE

The majority of the negatives you will shoot as a Navy Lithographer will be line negatives. In this chapter you will learn the steps and techniques used to produce line negatives from various types of copy.

As you study the following pages, keep in mind how important the negatives are to an offset printing job. Although the platemaker and pressmen are able to overcome many problems caused by poor negatives, negatives which have been properly exposed and processed always yield the best results. In many cases, a poor quality offset printing job can be traced to negatives that have been underexposed, overexposed, or improperly developed.

Standardization

In order to obtain consistent results in photography, it is necessary to standardize operations whenever possible. If you use the same materials in the same way each time, you can expect to get reasonably uniform results. On the other hand, guesswork and haphazard methods invariably result in poor work in addition to a waste of time and materials.

Another important point to observe when you are working in the darkroom, is to make just one change to your operations when you are having problems. For example, if the image develops slowly when you are processing a negative, the cause can probably be attributed to underexposure, cold developer, or old developer. (See Table 7-1, which follows this chapter.) To remedy this problem, you should make an exposure adjustment or check your developer. In this instance, you should check your developer first and either replace it or heat it to the proper temperature, if required, and process another piece of film. If the image continues to develop slowly, or your developer checked out satisfactory, then you should make an exposure adjustment. By making one change or check at a time, you are able to isolate the cause and observe the results to the change you have made.

The Copy

The copy is the most important factor for the cameraman to consider in planning his camera set-up. From the copy he decides:

1. The position of the camera lamps.
2. What type of film to use.
3. Which filter, if any, to use.
4. The proper lens aperture and exposure time.

When they are shooting line work, most cameramen expose for the background rather than the image, because it is the background which registers (as the black areas) on the film. If the copy is prepared on a tinted or colored stock, or on a stock having a very rough surface, less light is reflected into the camera and a longer exposure is necessary than is required if the copy is prepared on a smooth, white stock. There is no formula for determining how much the exposure must be increased. This is something you must learn from experience and test exposures.

If the copy background is too dark, it may be necessary for you to use another type of film or to use a filter. Since filters absorb part of the light, you must increase the exposure time. The term filter factor describes the number of times the basic exposure must be increased when a filter is used. The filter factor varies according to the filter itself, the type of light source used for the exposure, and the particular type of film you are using. To find the filter factor for the film and light source you are using, consult the film data sheet packaged with the film. The filter factors for Kodalith Ortho Film, Type 3 are shown in figure 7-1.

FILTER	LIGHT SOURCE		
	PULSED XENON ARC	CARBON ARC	TUNGSTEN QUARTZ-IODINE
GREEN (58)	3.0	4.0	2.5
BLUE (47B)	16	12	25
DP. YELLOW (15)	5.0	5.0	2.5
LT. YELLOW (K1)	2.0	2.5	1.5

57.711

Figure 7-1.—Filter factors for one type of film (Kodalith Ortho Type 3).

The exposure time for a line negative is also affected by the difference of size between the original copy and the size required of the negative. However, if the camera you are operating has a diaphragm control system, you can keep the exposure time constant. This device makes an adjustment to the lens aperture that regulates the amount of light for shots that are either enlargements or reductions. The diaphragm control system is discussed in greater detail in chapter 5.

STEP-BY STEP OPERATIONS

The procedures followed to obtain line negatives in this chapter are not written for any particular model camera or darkroom equipment. The equipment you will use will vary from shop to shop. There are slight differences in copyboards, lensboards, and focusing systems of cameras. Bear in mind that, although the physical structure of equipment varies, the principles of photography remain the same and operating procedures are usually similar.

Checking the Copy

Before you attempt to make a negative, you should carefully examine the copy for damage or apparent omissions. Check the work order or job jacket as well as the copy for any information or instructions you need to know. In most cases, the percentage of enlargement or reduction required will be written on the work order by the person who prepared it. If this information isn't furnished, you will have to use a scaling wheel (see fig. 5-33) to determine the focal settings.

Mounting the Copy

To mount the copy, tilt the copyboard to the horizontal position by releasing the catch at the base of the board. Unhook and raise the glass frame, and place the copy in the center of the copyboard, with the top of the image toward the lensboard (to the left). (See fig. 7-2.) You can determine the center by the reference marks on the bed of the copyboard. If the copy has large, unnecessary white margins, you can cover them with strips of black paper to reduce glare.

Next, check the copyboard glass to see that it is clean on both sides. Then close and lock the glass, switch on the vacuum pump, and turn the copyboard vacuum valve to the "on" position.

As soon as the air is exhausted from the copyboard frame, and the copy is pressed tight against the glass cover, return the copyboard to the vertical position and lock it in place.

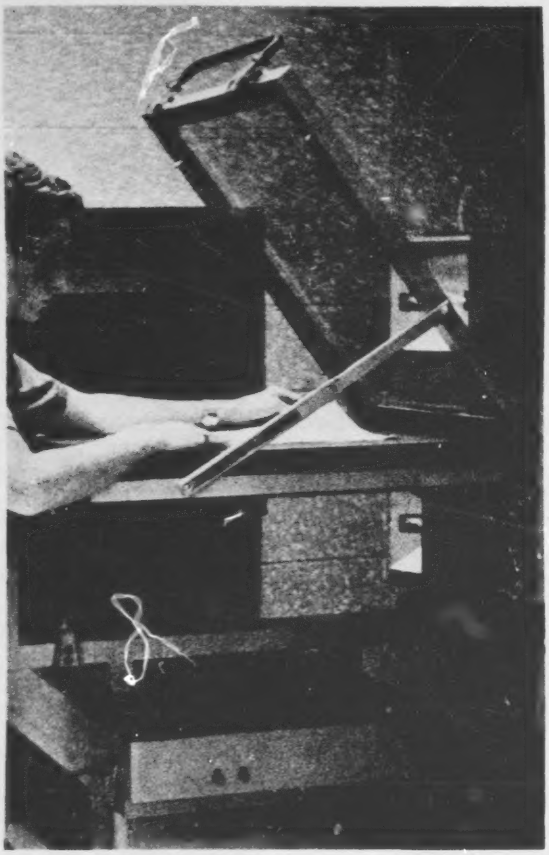
Setting the Camera Lamps and Lens

As a rule, cameramen keep the camera lamps at a predetermined angle and distance from the copyboard. Most cameramen have two positions for the lamps: one for normal work, and another for larger copy. Although it may differ, lamp to copyboard distance for normal work is generally three feet. At the start of each day, check the lamps to insure that they are working properly and that all the elements are lighting.

After the lamps have been checked, set the lens to the correct f/stop. A setting of f/22 for same size work is accepted as standard by most authorities.

Focusing the Camera

After you enter the darkroom, your next step is to focus the camera. The copy image is brought into focus by turning the handwheels that position the copyboard and lensboard. Their respective positions are indicated to you by the metal tape readings seen in the tape



57.712X

Figure 7-2.—The copy is mounted in the copyboard in the horizontal position.

viewing window. Most process cameras have red safe-lit viewing windows to aid you in accurately reading the tapes. If you are using panchromatic film, you will have to secure these lights when the film is being loaded on the vacuum back. Otherwise you will expose the film because of its sensitivity to red light.

If test negatives have shown that the camera scales are accurate, you may focus most jobs by just using the handwheels and tape readings. If they aren't accurate, or if the job is critical work, it will require further visual focusing.

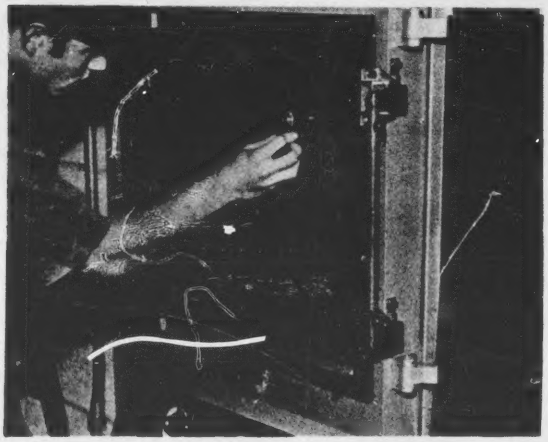
To focus the camera visually, move the lensboard and the copyboard until you reach the proper settings on the tapes. Then swing the vacuum back either down or to the side, depending on the model camera you are using, and swing the ground glass into the focal plane. Next, set the master switch on the control panel to the "on" position, and then open the shutter and turn on the lights by moving the arc and shutter switches to the "manual" positions.

Measure the image on the ground glass with a ruler or check the dimensions with markings previously prepared on the glass. If adjustments for size are necessary, first move the lensboard; then relocate the copyboard and bring the image into focus. If the image consists of very fine lines, you should examine it with a magnifier to ensure that it is sharp. When the size is correct and the image is sharp, lock the copyboard and lensboard in position.

When focusing the camera visually, cameramen sometimes prefer to have the lens diaphragm wide open, because the wider opening admits more light to the camera and produces a brighter image on the ground glass. This is not necessary, as a rule, if the focal length of the lens is over 10 inches, but it is useful for lenses with very short focal lengths. Once the image is in focus, you should stop the lens down to the aperture you will use for the exposure, and again check the focus. This is necessary because the focus sometimes changes as the lens is stopped down. In such cases, it is necessary to focus the camera at the aperture to be used for the exposure. Fine line work should always be focused with the aperture to be used for the exposure, and the image should be examined with a magnifier before the exposure. As you can see in figure 7-3, there are small clear spaces on the ground glass. These are the best places to check critical focus with a magnifier.

Loading the Film

Once the focusing is completed, switch off the lights and close the shutter. Then, move the ground glass out of the way and move the vacuum back to its loading (horizontal) position. Center the film on the vacuum back with the emulsion side up, so that the emulsion will face the lens when the camera back is closed for the exposure. (See fig. 7-4.) If you are using colorblind or ortho film, you can determine the emulsion side by examining the film at a



57.713X

Figure 7-3.–A magnifier is placed over the clear areas of the ground glass to check the critical focus of the copy.

reasonable distance from the safelight. The emulsion side is always the light, dull side. If you are using pan film (and must work in total darkness), you can tell the emulsion side from the notches in the upper right corner. Another method of determining the emulsion side is to moisten your lips and press a corner of the film between them. The emulsion side will stick to your lip.

You have already seen in chapter 5 how to control the vacuum on the vacuum back. Once the vacuum has been switched on, and the film is flat on the surface, raise the back to its vertical position and lock it in place.

Exposing the Film

You are now ready to expose the film. The camera you are operating will have a control panel similar to the one shown in figure 7-5. In addition to a timing device, these panels have individual switches that control the power supply, the camera lamps, and the shutter.

To set the panel for an exposure the lamp and shutter switches must be placed in the "automatic" position and the power switch is placed in the "on" position. The timer is set by moving the selector hand to desired number of seconds. The start button is then pressed, which simultaneously opens the shutter and energizes the lamps and counter. When the exposure is completed, the lamps are shut off and the shutter is automatically closed.

Although it is impossible to designate an exact exposure time for a particular film and camera set-up, you can find a recommended exposure from the manufacturer's film data sheet. Of course, if your set-up varies, your exposure times will also vary. The age and speed of the film you are using as well as the nature of your copy are factors that will affect the length of your exposures.

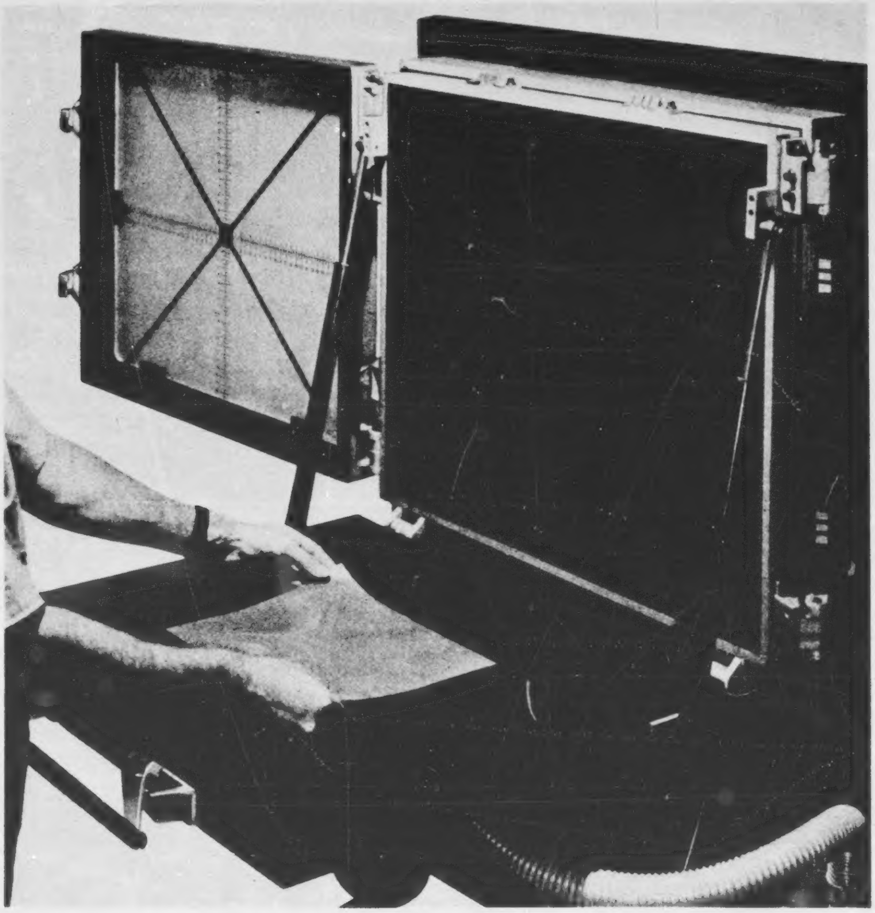
Film Processing

If your darkroom is equipped with a temperature controlled sink, you can expect to obtain uniform results when you develop your negatives by the time-temperature method. This method is discussed in chapter 6.

If you do not have a temperature controlled sink, you should keep a thermometer in the developer so you can quickly determine the correct developing time by consulting a time-temperature chart like the one shown in figure 6-12.

Once you have determined the correct development time, set the darkroom timer for the amount of time required. Immerse the film uniformly in the developer by first drawing it emulsion side down through the developer. Then quickly flip it over and let the film rest on the bottom of the developing tray. (See fig. 7-6.) During the development, you should agitate the developer continuously with a smooth, rocking motion of the tray.

When the developing time has elapsed, remove the film from the developer and place it in the stop bath solution to quickly stop all development. After 10 to 15 seconds in the stop bath, place the film in the fixing solution. When the milky appearance is gone from the image areas, you can turn on the regular lights in the darkroom if all unexposed film in the darkroom is protected from the lights. The total time the negative must remain in the fixing solution varies according to the type of film and fixing solutions you are using.



57.714X

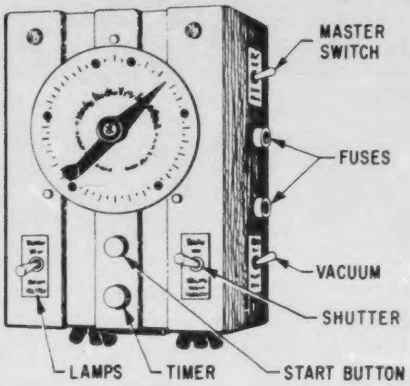
Figure 7-4.—The film is centered on the vacuum back with the emulsion side facing out.

You can determine the correct amount of time by consulting the film data sheet. After fixing, the negative must be given a thorough wash in running water to remove all traces of the processing solutions. Usually the film should be washed for a minimum of ten minutes.

Inspection

After the film has been processed, you should examine the negative for quality. It isn't necessary to dry the negative completely before inspecting it; use a squeegee and a clean flat surface to wipe off the excess water.

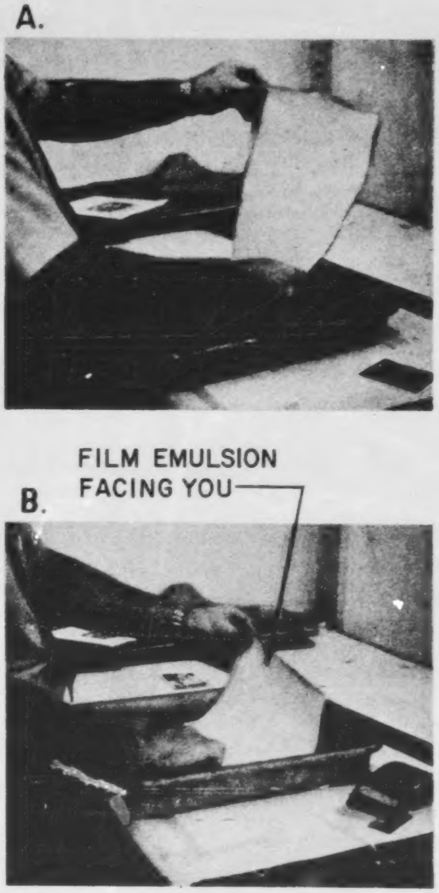
Place the negative on a light table, emulsion side down, and examine it closely with a magnifier. A properly exposed and processed negative will have clear, sharp transparent (image) areas. The black (non-image) areas should appear dense throughout with few pinholes. Also check that you have followed any special instructions and that the complete image is on the negative.



57.113.7

Figure 7-5.—A typical camera control panel.

Compare your negatives to the samples shown in figure 7-7. As you can see, the good negative has sharp, clear transparent areas. The other two negatives are not acceptable. They lack the sharp detail in the image areas. When you are examining negative quality, have a specific point in mind to check. Some experienced cameramen use the small openings in the letters "A" and "e" as to their quality checks; others look at the tips of the letters "m" and "w". If the images are sharp and clear in these areas, the negative should be acceptable.



57.715

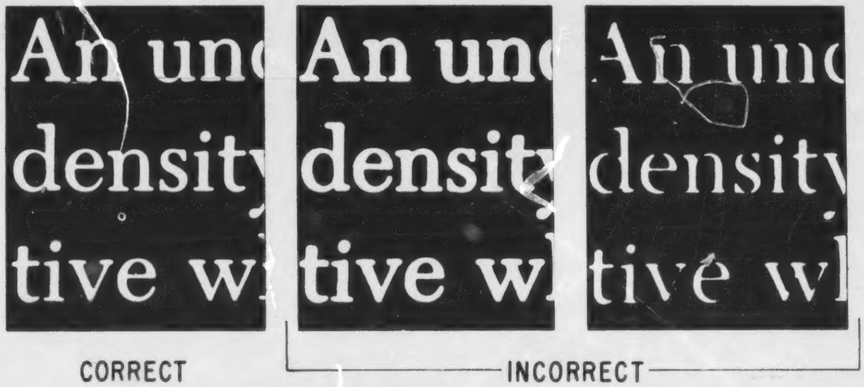
Figure 7-6.—To begin development, the film is quickly drawn through the developer (A); then it is flipped over with the emulsion side facing up in the tray (B).

SENSITIVITY GUIDES

Many cameramen use a sensitivity guide similar to the one shown in figure 7-8 when they are photographing line copy. The guide is placed in an open area of the copy in the copyboard. The best location for the guide is in the center of the copy, although it can be placed along the copy edge. The image of the guide as it appears on the film being developed is used as a gage to indicate when the film has been developed to the correct point. The cameraman refers to a chart to learn which step should be developed solid for the type of copy he is photographing. (See fig. 7-9.)

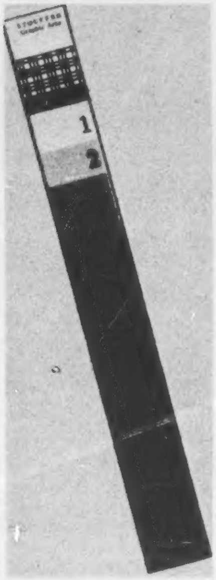
For example, you can see from the chart that for normal copy shot at 40% to 120% of original size, step 4 on the guide should be developed solid (black) to obtain a negative of the correct density. If the same shot is being made of copy that consists of fine lines, step 3 should be developed solid (black) to obtain the correct negative density.

The sensitivity guide must be cut from the negative or masked out when the negative is stripped into the flat. There are similar sensitivity guides that may be used in platemaking, which are discussed in chapter 10.



57.716X

Figure 7-7.—The image areas of a negative appear sharp and clear when it has been properly exposed and processed.



57.183(57C)X

Figure 7-8.—The Stouffer Sensitivity guide may be used as a visual aid to determine when the correct development of line negatives has been attained. The two patterned areas at the top can be used to check the camera's focusing system.

POSITIVE COPIES

Occasionally, it will be necessary for you to make positive copies on film for overprints, and other purposes. You can make these positives with the enlarger, by copying in the process camera, by contact printing, or by using reversal type film.

Using the enlarger, you would proceed much as if you were making enlargements on paper; place the negative in the carrier, focus the image on the easel, place the film in position, and expose. You should remember that most process films you would use for making positives are considerably faster than enlarging papers, and you must decrease your exposure accordingly.

You can make positive copies by placing the negative in front of the process camera on a piece of opal glass and putting a lamp behind it for illumination. Opal glass is a white, translucent glass, similar to the ground glass at the camera back. Some types of cameras have a cut-out in the center of the copyboard in which opal glass may be mounted for this "backlighting" exposure of negatives and transparencies. The light source must not shine directly into the lens. Some cameramen construct a light tunnel from sheets of index paper and mount it from the lens to the negative to prevent unwanted reflections.

DENSITY OF COPY	SIZE OF COPY 10-40%	 40-120%	 120-400%
EXTRA HEAVY COPY BLACK BOLD TYPE ETCHING PROOFS PHOTO PROOFS	4 BLACK	5 BLACK	6 BLACK
NORMAL COPY GOOD BLACK TYPE PROOFS WITH FINE SERIFS PEN AND INK DRAWINGS PRINTED FORMS	3 BLACK	4 BLACK	5 BLACK
LIGHT COPY GREY COPY ORDINARY TYPEWRITTEN SHEETS PRINTED FORMS LIGHT LINES GOOD PENCIL DRAWINGS	2 BLACK	3 BLACK	4 BLACK
EXTRA LIGHT COPY EXTRA FINE LINES PENCIL DRAWINGS EXTRA LIGHT GREY COPY	1-2 BLACK	2 BLACK	3 BLACK

57.717X

Figure 7-9.—Chart used with the Stouffer Sensitivity Guide.

To make a contact positive, you should place the negative over a piece of film, (emulsion to emulsion), in the vacuum printer. Close the frame, exhaust the air, and expose the film. You should use a weak, diffuse light, placed far enough from the emulsion so that an exposure of 10 seconds or more is required. This may require the use of a small bulb in a safelight housing, or a variable density filter over the light source.

Autopositive and duplicating films, which were discussed in chapter 6, may also be used to produce positive copies of negatives. Generally, these products are used in a vacuum printer, as outlined above. They are exposed through amber sheeting (to eliminate all blue and blue-violet light) to a strong light source, such as arc lamps or pulsed xenon lamps. They are then processed much as normal work, but developing is done with continuous agitation (the tray is rocked constantly throughout the developing period). Specific instructions for the various types of direct positive materials are packed with each box. This system is frequently used in commercial shops for making duplicate negatives.

NEGATIVES FOR COLOR REPRODUCTION

Regulations regarding color printing are set forth in the Department of the Navy Publications and Printing Regulations (NavExos P-35). In general, color should not be used for decorative purposes; it should be used only when it has a functional value.

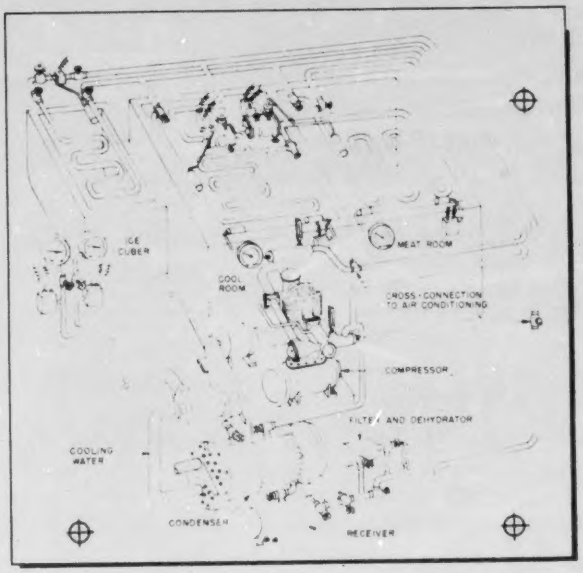
If you do have occasion to work with color, you will find that it is a simple matter to make line shots for color reproduction if the copy has been properly prepared. As you have seen in chapter 4, if the colors do not overlap, a simple black-and-white drawing is all that is required. It should have a tissue overlay attached to indicate the parts of the drawing that are to go in color and the colors to be used. You then shoot as many negatives from the original as are necessary to reproduce the number of colors desired, and mask off each negative so that only the desired color areas are printed on the plate. If the work is very simple, you may be able to use a paper mask and shift it about, so that plates for all colors can be made from the same negative. By using both water-soluble and alcohol-soluble opaques, as you will learn to do in chapter 9, several color printing plates can be made from the same negative.

When colors overlap, it is best to have a separate black-and-white drawing for each color and to make a separate negative from each drawing. Figure 7-10 illustrates artwork prepared for a two-color job.

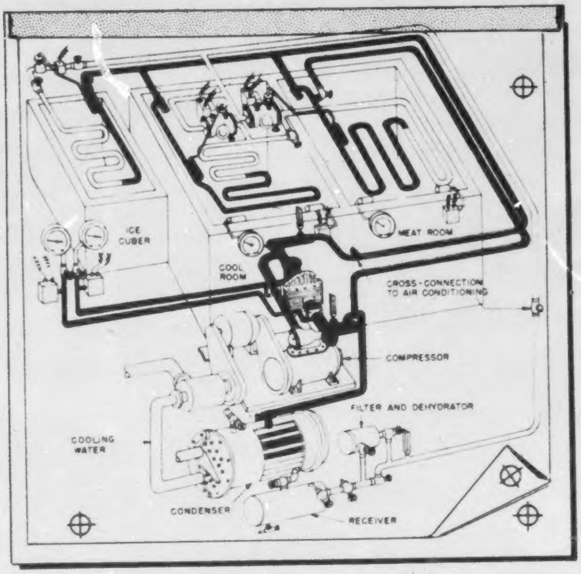
If the copy is prepared in color, you may have to use filters. Sometimes it may be simpler to ask the artist to re-do the copy in black-and-white.

COLORED COPY

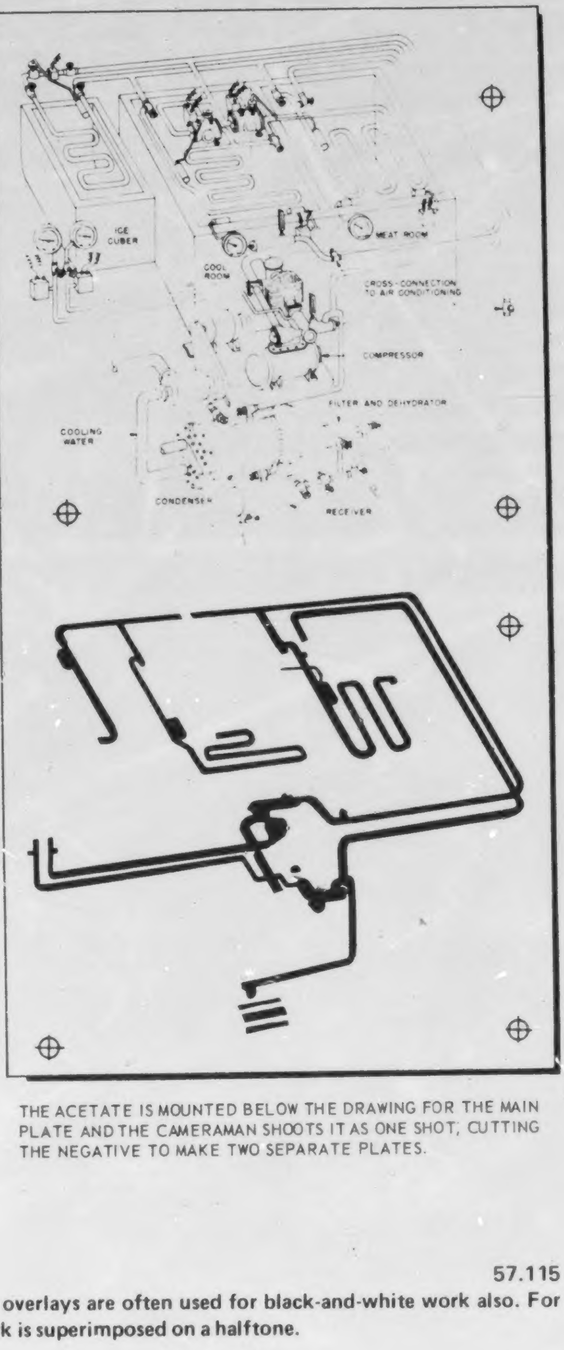
If you use the proper type of film, you may be able to photograph colored copy without the use of filters. Sometimes, however, there is so little contrast between the subject and the background that filters are indispensable. When


ICE CUBER
COOL ROOM
MEAT ROOM
CROSS-CONNECTION TO AIR CONDITIONING
COMPRESSOR
FILTER AND DEHYDRATOR
COOLING WATER
CONDENSER
RECEIVER

THE ART WORK FOR THE BLACK (OR THE MAIN COLOR) IS DRAWN IN BLACK INDIA INK ON WHITE DRAWING BOARD.


ICE CUBER
COOL ROOM
MEAT ROOM
CROSS-CONNECTION TO AIR CONDITIONING
COMPRESSOR
FILTER AND DEHYDRATOR
COOLING WATER
CONDENSER
RECEIVER

AN ACETATE OVERLAY IS ATTACHED TO THE DRAWING AND THE MATERIAL FOR THE SECOND COLOR IS DRAWN IN ON THE ACETATE IN BLACK INK.


ICE CUBER
COOL ROOM
MEAT ROOM
CROSS-CONNECTION TO AIR CONDITIONING
COMPRESSOR
FILTER AND DEHYDRATOR
COOLING WATER
CONDENSER
RECEIVER

THE ACETATE IS MOUNTED BELOW THE DRAWING FOR THE MAIN PLATE AND THE CAMERAMAN SHOOTS IT AS ONE SHOT, CUTTING THE NEGATIVE TO MAKE TWO SEPARATE PLATES.

57.115

Figure 7-10.—Artwork prepared for a two-color job. Acetate overlays are often used for black-and-white work also. For example, when lettering or line work is superimposed on a halftone.

the subject is to be made dark against a light background, you should select the filter which will transmit the color of the background and absorb the color of the subject, so that it will photograph as black. Figure 7-11 shows combinations of filters and films to photograph various colors.

If you write on paper with a red crayon and try to read it by the red safelight in the darkroom, you will find that the lettering is practically invisible. But if you were to look at the lettering under a mercury-vapor lamp it would appear black because this lamp gives off no red radiation. That is the effect of the filter. Filters transmit some colors freely, making them photograph as white or light shades of gray; and they absorb the radiations of other colors, making them photograph as black or deep shades of gray.

Orthochromatic film is the workhorse of the litho shop because it is suitable for almost all types of work. However, panchromatic film must be used when red filters are required because ortho films are not sensitive to red. Since the light entering the camera assumes the same color as the filter, no image will register on the film if a red filter is used with ortho film because all light striking the film will be red.

Whenever you are required to photograph colored copy, you may find the following hints helpful:

1. To DROP a color use a filter of the same color, preferably darker than the color you wish to drop.
2. To HOLD a color use a filter which is complementary to the color which you wish to hold.
3. Use a green filter to intensify pencil drawings.
4. To obtain a negative of a blueprint use panchromatic film and a red filter.
5. If the copy you are photographing has a signature in blue ink, use a yellow filter.
6. Yellow stains and other discolorations can often be dropped from the negative by use of a yellow filter. If the stains are severe, however, it may be necessary to retouch the copy to obtain a satisfactory negative.

FILM AND FILTER GUIDE

FILTER TO USE TO PHOTOGRAPH AS BLACK (HOLD)			FILTER TO USE TO PHOTOGRAPH AS WHITE (DROP)	
PANCHROMATIC-ORTHOCHROMATIC		COLOR	PANCHROMATIC-ORTHOCHROMATIC	
C5	NONE	RED	A	-
K2 or G	K2 or G	BLUE	C5	C5
C5	C5	YELLOW	A or G	K2 or G
A	C5	GREEN	B	B or K2
B	K2	VIOLET	C5	C5
B or C5	C5	ORANGE	A or G	K2 or G

WRATTEN FILTERS ARE DESIGNATED AS FOLLOWS:

A	RED (#25)	G	DEEP YELLOW (#15)
B	GREEN (#58)	K1	LIGHT YELLOW (#6)
C5	BLUE (#47)	K2	YELLOW (#8)

57.718

Figure 7-11.–Film and filter combinations used to photograph various colors. Because of variations in film emulsions and specific color hue, it may be necessary to use combinations of filters for some copy.

7. Overexposure will help to drop a color when no filter is used. Underexposure will help hold a color when no filter is used.

THE CAMERAMAN'S DAILY DOZEN

1. Check and clean camera.
2. Clean utensils and prepare solutions.
3. Check copy for defects; check sizing and instructions. If necessary, use scaling wheel to find positions for copyboard and lensboard tapes, and proper aperture.
4. Mount copy centrally in copyboard; cover unnecessary white margins with black paper.
5. Adjust copyboard and lensboard for enlargement or reduction as required.
6. Check camera lamps; set iris diaphragm. If visual focusing is necessary, open shutter and turn on lamps, then check focus on ground glass at camera back.

7. Set lamp and shutter switches to automatic positions when focusing is completed; set time for exposure required.
8. Mount film on vacuum back, swing vacuum back into place and lock.
9. Flip switch to open shutter and turn on lamps. At end of the required time, shutter will close and lamps will turn off automatically.
10. Develop negative for required time; then rinse, fix and wash.
11. Examine wet negative for quality over light table. After negative has dried, check it against copy for size and detail.
12. Make test exposures for uncertain copy or film.

CLASSIFIED MATTER

When photographing classified matter, precautions must be taken to prevent possible loss and compromise. Of course, all personnel handling the job must be cleared for access; and all others should be denied entry into the cameraroom and darkroom.

Care must be taken to account for all copy (including text and artwork), and all negatives and positives produced.

Negatives and positives not satisfactory for reproduction must be handled as classified waste, and placed in approved storage containers (safes, vaults, etc.) until they can be destroyed.

Film negatives and positives cannot be destroyed by shredding and pulping. The only secure method of destruction is by burning. Some paper negatives may be reduced to pulp. If your shop uses a pulping machine for destruction, you may try to pulp an unclassified paper negative first, before attempting to destroy classified ones.

Table 7-1.—Negative Difficulties

Difficulty	Cause	Remedy
1. Image does not develop	1. Negative not exposed	1. Check lens, shutter, and camera lamps for failure to operate properly
	2. Oxidized developer (age or contaminated)	2. Replace with fresh developer
	3. Cold developer	3. Heat to 68° F.
2. Develops too slowly	1. Underexposed	1. Check aperture and full coverage of lamps; check filter factor, colored background; increase exposure as necessary
	2. Cold developer	2. Heat to 68°F
	3. Old developer (muddy color, slow action on test strip)	3. Drain developer, clean tray, replace with fresh developer; check water for impurities, use distilled water if necessary
3. Develops too quickly	1. Overexposed	1. Check aperture and lamps; correct position; reduce exposure time
	2. Warm developer	2. Cool to 68°F, if possible; otherwise dilute developer or reduce developing time; use prehardener if necessary
4. Clears too slowly or not at all in fixing bath	1. Old or spent fixer	1. Drain fixer, clean tray, replace with fresh fixer
5. Negative veiled or fogged in clear areas	1. General	1. Reducing bath (Farmer's) may clear fog to produce satisfactory negative. Use single bath for reducing overexposed film; two solution bath for over developed film.
	2. Overexposure	2. Reduce exposure so image first appears in 30-45 seconds (process film at 68°F); reduce with single solution Farmer's Reducer
	3. Overdevelopment	3. Develop only for required time; reduce temperature to 68°F; check for underexposure
	4. Old developer (requires excess developing time)	4. Replace with fresh developer
	5. Reflected light	5. Adjust lights to prevent reflections from lamps or copyboard

57.564

Table 7-1.—Negative Difficulties—Continued

Difficulty	Cause	Remedy
	6. Light leaks	6. Check camera bellows, lensboard, and darkroom seals
	7. Dirty copyboard glass	7. Clean both sides of glass; keep cameraroom clean and well ventilated
	8. Old or fogged film	8. Replace film; use film before expiration date; check for radiation
6. Uneven development	1. Uneven contact with developer	1. Immerse film quickly and evenly into developer, with emulsion side down
	2. Uneven action of developer	2. Agitate to mix developer and equalize temperature
7. Reticulation or blistering	1. Extreme temperature variation	1. Keep all processing baths at same temperature; use prehardener or hardener bath above 75°F; fan-dry negatives
8. Negative lacks overall density	1. Underexposed or underdeveloped	1. Check aperture and lamps for exposure; check developer for age or adjust development time
9. Negative thin in corners	1. Uneven illumination	1. Increase distance of lamps to copyboard and correct exposure; mount diffusers or reflectors to spread light to edges of copy; stop lens down and increase exposure time.
10. Blurred image	1. Out of focus 2. Camera motion	1. Check image on ground glass 2. Check for vibration

CHAPTER 8

THE HALFTONE NEGATIVE

THE STORY OF THE HALFTONE

One does not have to dig too far back into history recall a period when the Gibson girl was all the rage. Figure 8-1 shows a typical pinup girl of that period. Since the modern halftone process had not yet been perfected, actual photographs could not be reproduced. All illustrations consisted of line drawings and woodcuts. (See fig. 8-2.)

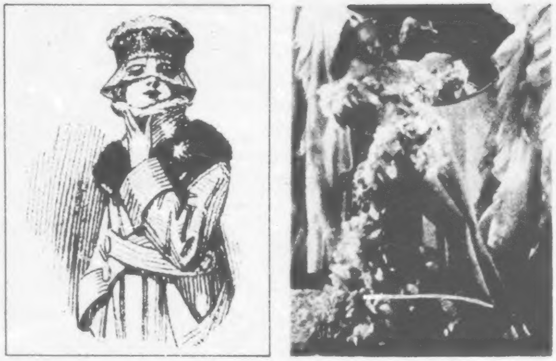
Things have changed since the turn of the century, however. Hundreds of new inventions have appeared and many of the old ones have been brought up to date. Even the pinup girl has gone modern—and so have the methods of printing her. We are now able to reproduce photographs without loss of tone values.

In 1878, Frederick E. Ives, head of the photographic research department at Cornell University, developed the first satisfactory method of breaking a photograph into a series of small dots. When printed, these dots blended together to give the appearance of continuous tone. (See fig. 8-3.)

Although Ives discovered the first satisfactory method of reproducing halftones, a number of other men also contributed to the development of this great process. It was not until Max Levy invented a practical halftone screen in 1893 that photoengravers took up halftone work in earnest.

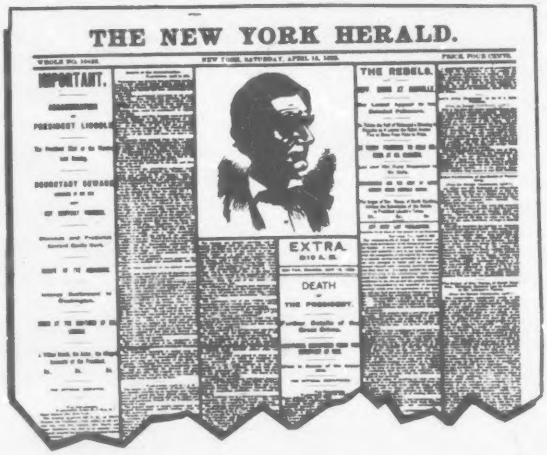
Screens made from silk cloth and wire mesh, and negatives from ruled and checkerboard ink drawings had all been tried without success before Levy came out with a diamond-ruled, cross-lined sealed screen.

The glass halftone screen was used exclusively for many years and it is still in use in many commercial shops. It is also used in camera-processors in making camera-direct plates which will be described in chapter 10. The glass screen will be discussed briefly to acquaint you with its



57.117X

Figure 8-1.—The pinup girl has changed and so have the methods of printing her.



THE NEW YORK HERALD.

IMPORTANT.

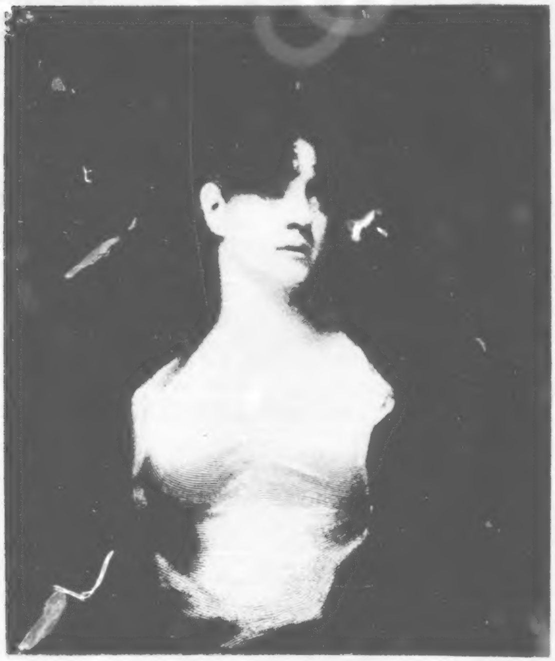
THE REBELS.

EXTRA

DEATH

57.118

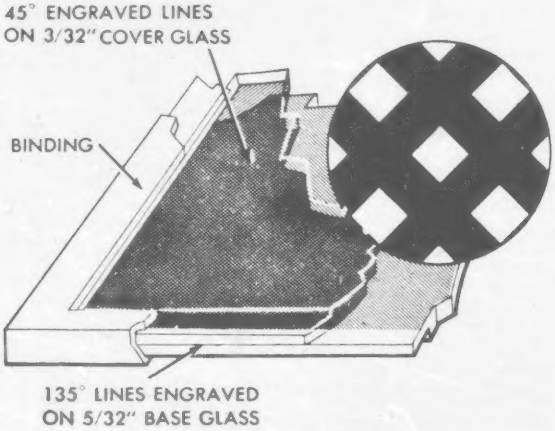
Figure 8-2.—Until a few years ago, only line drawings could be reproduced in print.



57.119X

Figure 8-3.—Early wood engravers had the first idea for producing tone, but their process was too slow and tedious.

salient features; however, this chapter will deal mainly with the contact screen, a newer type of screen having an acetate or plastic base, since most Navy shops now use this screen in making their halftones.



57.120

Figure 8-4.—Section of a glass halftone screen.

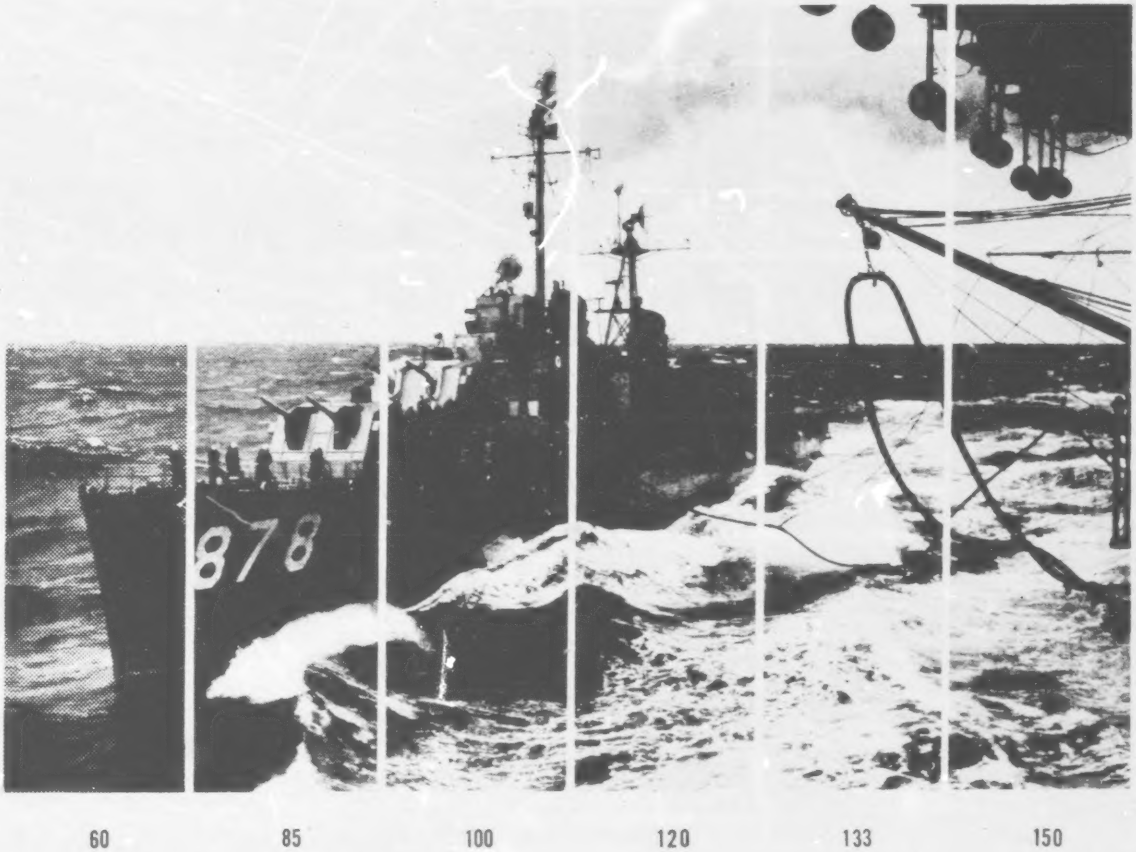
GLASS HALFTONE SCREEN

The glass halftone screen consists of two sheets of optical glass, each of which has fine parallel lines etched on one side. These lines are filled with a pigment to make them opaque and the sheets of glass are sealed with the etched surfaces together so that the parallel lines cross each other at right angles. (See fig. 8-4.) Halftone screens are available in standard rulings of from 50 to 400 lines per inch. A 100-line screen, for example, has 100 lines and 100 transparent openings to the linear inch. See figure 8-5 for the effect that the use of different line rulings has.

Glass halftone screens are always placed in the camera a short distance in front of the film[1] in such a manner that the light projected from the lens must pass through the openings in the screen before it reaches the film. The crosslines of the screen form a pattern that breaks up the light and causes it to register on the film as a series of small, individual dots, each varying in size according to the amount of light being reflected from the copy at that particular point. Because some areas of the copy are brighter and reflect more light than other areas, dots of varying sizes are produced on the film and this creates an illusion of tone ranging from light gray to black. (See fig. 8-6.)

---

[1] The distance between the screen and the film (screen distance) is determined by a mathematical formula which states that the screen distance should be in the same proportion to the screen opening as the camera extension is to the lens opening. Cameramen normally use the same screen distance for all exposures made with a particular screen, but they may vary the distance to control contrast or for other reasons when they are shooting special types of copy. They also change the screen distance when they are using a coarser or finer screen because the size of the screen opening varies and this affects the screen distance.



57.121

Figure 8-5.—Screen rulings generally used. Small differences in the number of lines per inch are almost unnoticeable to the eye.

The light tends to fan out on the film and the size of the dots grow with prolonged exposure, large apertures, and fast film emulsions. Therefore, the dot formation is dependent not only on the intensity of the light reflected from the original copy and the distance between the film and screen (screen distance) but also on the size and shape of the lens aperture, the speed and contrast of the film emulsion, and the duration of the exposure.

Multiple Exposures

As you know, only one exposure is required for line negatives. Halftone negatives can be made with one exposure too, but the negative will be flat. Cameramen have found that they can attain better contrast if they divide the total exposure time into a series of two or more exposures, each made through a different lens opening. One exposure is made to bring out the highlights of the copy; one is made for the middletones; and another is made for the detail. In addition, a supplementary exposure, called a flash, is usually included to introduce a fine pinpoint dot into the shadow areas. (See fig. 8-7.) The middletone exposure is omitted if sufficient contrast control can be obtained with the other apertures.

57.123

Figure 8-6.—How the halftone dots blend together to produce an illusion of continuous tone.

The f/45 lens opening is generally used as a basis for the detail exposure. (The f/45 is used if the copy is to be shot same-size, but if the copy is to be enlarged or reduced, a corresponding value of this opening is used. For example, f/22 is used instead of the f/45 stop if the copy is to be enlarged three times.)

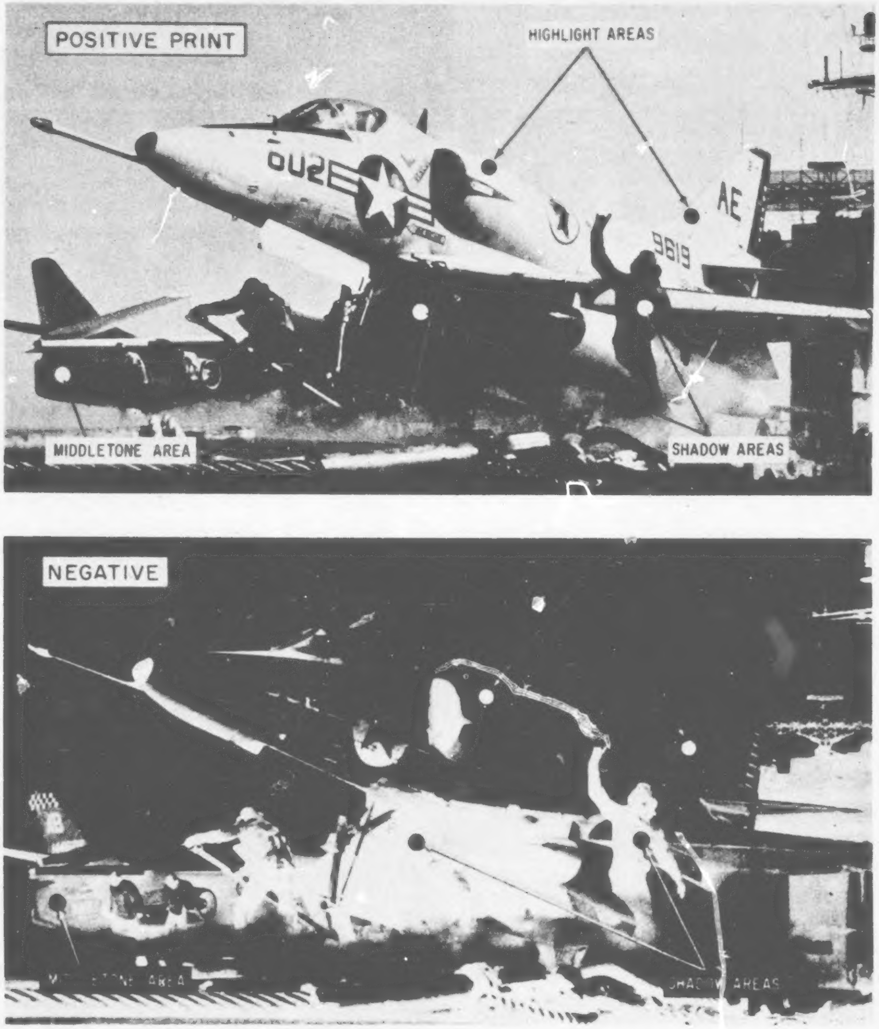
If the detail exposure were used alone, the negative would be flat, so to snap it up, the cameraman changes the lens opening without disturbing any of the other camera settings and then makes a second (highlight) exposure on the same piece of film. The f/22 opening is generally used as a basis for the highlight exposure. This exposure, given to record the bright areas of the copy is usually of very short duration, requiring about one-fourth as much time as the detail exposure. Because a larger aperture is used for the highlight exposure, more light is admitted to the camera and this produces a larger dot on the film. However, since the highlight exposure is so short only the light from the brightest highlight areas of the copy has time to register on the film. The gray and shadow areas of the copy reflect less light than the highlights, so the light from these areas does not have time to penetrate the film emulsion. Therefore, the highlight dots spread and grow until only a small, transparent opening is left between them, but there is little change in the size or opacity of the shadow and middletone dots. (See fig. 8-8.)

The two exposures take care of the highlight and detail areas, but as you can see in figure 8-8 the shadow areas are still underexposed, having weak, transparent dots in some areas and no dots at all in other areas. If such a negative were to be printed on a plate, the shadow areas would tend to fill in solid and most of the shadow detail would be lost.

So the cameraman uses a flash exposure to increase the density of those dots and to provide dots where none exist in the shadow areas. He uses a small aperture (generally f/90) as a basis for the flash exposure and the exposure is of short duration—about the same length of time as that required for the highlight exposure. He covers the copy with a sheet of white paper during the flash[2] and the white paper photographs as a highlight. But since the lens opening is so small and the exposure so short, the flash produces a very small, opaque dot. This opaque dot provides a dense, hard core for all the dots on the negative, but since it is so small, it does not alter their size; it simply increases their opacity in the center. (See fig. 8-8.) Flashing preserves detail in the shadow areas by building

---

[2] Instead of using white paper over the copy in making the flash exposure, the cameraman may shine a light directly into the camera through the lens.


POSITIVE PRINT
HIGHLIGHT AREAS
0U2
AE
9619
MIDDLETONE AREA
SHADOW AREAS
NEGATIVE
MIDDLETONE AREA
SHADOW AREAS

57.719

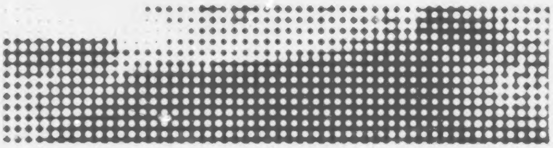
Figure 8-7.—As you can see here, the highlights are the whitest areas of the copy and the blackest areas on the negative. The shadows are the darkest areas of the copy and are almost transparent on the negative. The middle-tones are gray on both the copy and the negative.

up the opacity of the dots so that they will not be lost when the negative is printed on the plate.

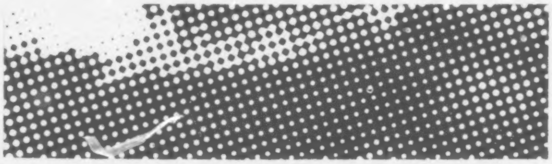
Multiple exposures may be made in any order and in any combination of exposure times. (See figs. 8-9, 8-10, and 8-11.)

Exposure Time

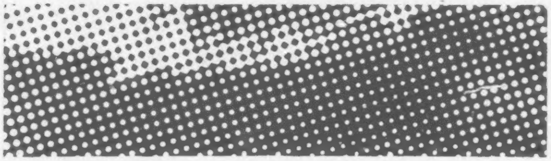
The exposure time varies with the type of lighting, the speed of the film and other shop conditions. For this reason, the cameraman must



DETAIL EXPOSURE. NOTICE THAT HIGHLIGHT DOTS ARE SMALL AND THAT DOTS IN SHADOW AREAS ARE WEAK OR MISSING.



HIGHLIGHT EXPOSURE INCREASES SIZES OF HIGHLIGHT DOTS, BUT HAS LITTLE EFFECT ON DOTS IN SHADOW AREAS.



FLASH EXPOSURE BUILDS UP DOTS IN SHADOW AREAS, BUT DOES NOT AFFECT SIZE OF DETAIL OR HIGHLIGHT DOTS.

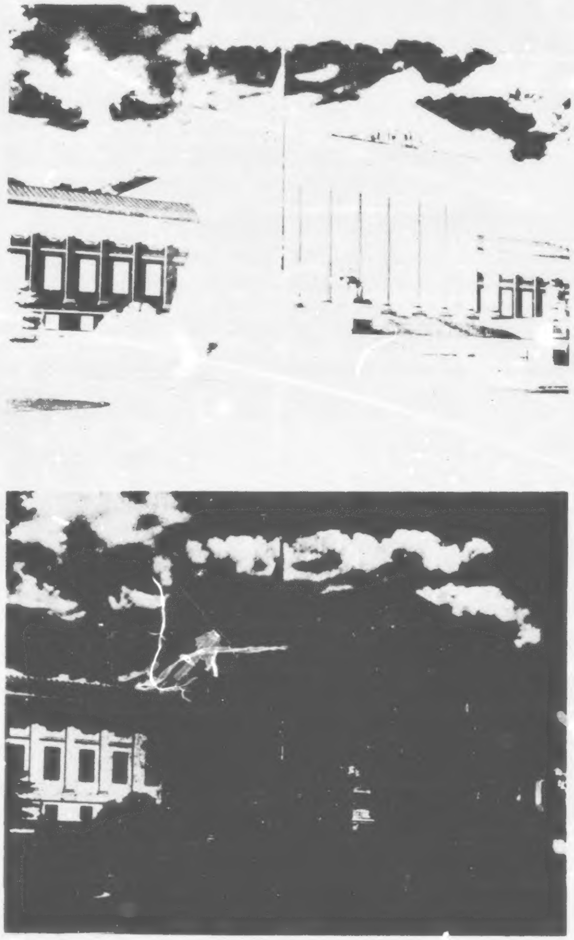
113.74

Figure 8-8.—Results of multiple halftone exposures.

determine the correct exposure time experimentally at first, just as he does in making a line negative. Once the exposure time has been established, it remains fairly constant for all ratios of enlargements or reductions which follow.

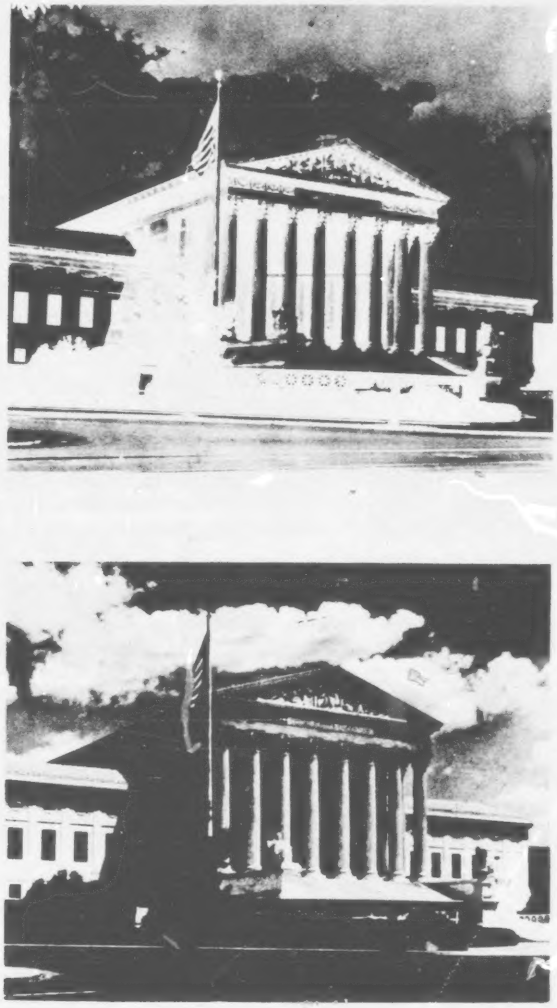
Screen Angle

Glass halftone screens come in rectangular and circular forms and in a wide variety of sizes and rulings. Rectangular screens are used for straight black-and-white work. They are built so that the rulings cross each other at a 45 degree angle to the camera. The 45 degree angle is chosen because it makes the dot pattern produced by the screen less noticeable to the eye. The circular screens are used primarily for color-separation work where the angle of the ruling must be changed for each color. Since images from red, blue, yellow, and black plates print one over another in color work, the cameraman turns the screen to a different angle when he makes the negatives for each color. This causes some of the dots to overlap and some to print side by side when the job is printed on the press. He generally uses a 45 degree angle for the image on the black plate; a 75 degree angle for the red; a 90 degree angle for the yellow; and a 105 degree angle for the blue.



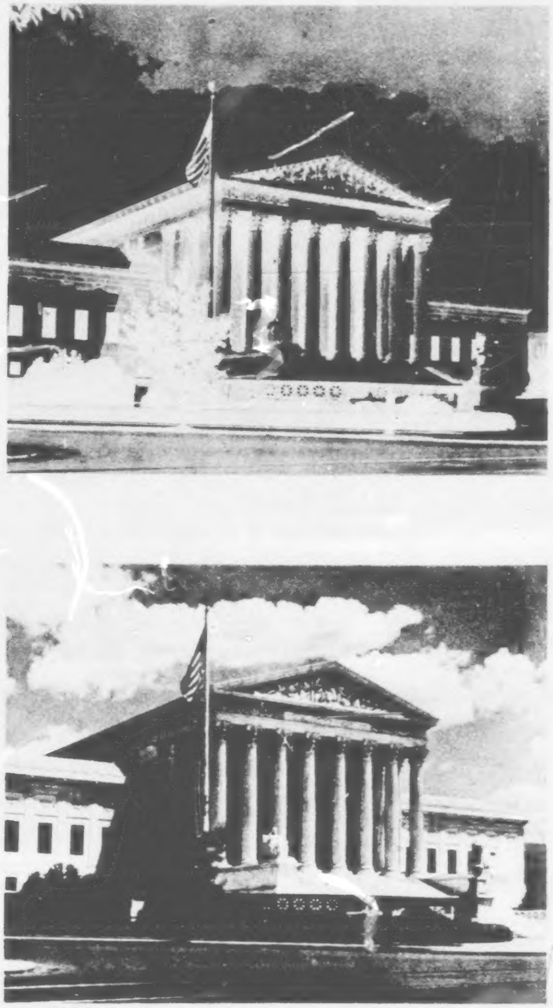
113.75X

Figure 8-9.—Above, negative made with highlight exposure only. Below, proof from plate made with negative.



113.76X

Figure 8-10.—Above, negative made with detail and highlight exposure. Below proof from plate made with negative.



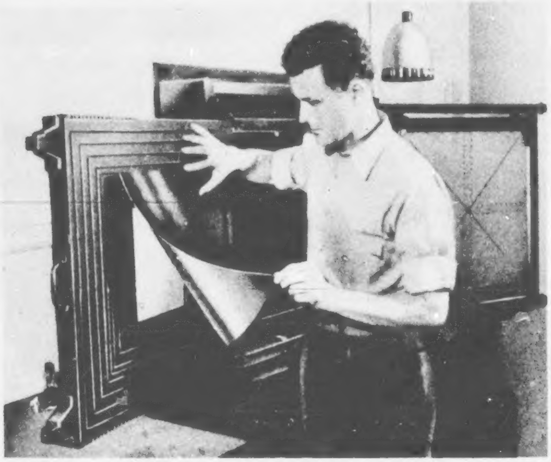
113.77X

Figure 8-11.—Above, negative made with detail, highlight, and flash exposure. Below, proof from plate made with negative.

CONTACT SCREENS

In addition to the glass halftone screens just discussed, there is another type of screen which has a safety film base. This screen is known as a contact screen because it is used in direct contact with the film when the exposure is made. (See fig. 8-12.) Contact screens are available in standard rulings of 50 to 400 dots per linear inch. The finer rulings enable the cameraman to capture better detail than is possible with the coarser screens.

Contact screens are not as fragile as glass halftone screens. They also provide better rendition of tone because the dots take the form of the subject detail and create a smoother optical illusion. They are easily scratched, however, and



57.140X

Figure 8-12.—The contact screen is used in direct contact (emulsion to emulsion) with the film. You can tell the emulsion side of the screen by holding the screen up and looking at the printing along the edge. If the printing is readable left to right, the emulsion side is facing you.

they may also be marred by waterspots, fingerprints, scratches, and embossing from the edges of the film. They also fade or lose their color with time and prolonged use and this changes their reproduction characteristics.

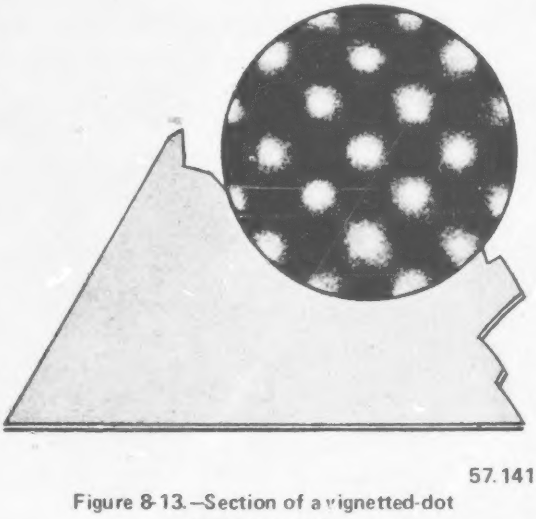
There are many types of contact screens and they are sold by a number of different companies. The Eastman Kodak Company, for example, manufactures a Negative Magenta Contact Screen for producing halftone negatives; a Positive Magenta Contact Screen for producing halftone positives from continuous-tone negatives in color-separation work; a Magenta Contact Screen for Photogravure; and a Gray Contact Screen which is used for black-and-white work and for producing color-separation negatives from colored copy.

Each of these screens is designed for a specific purpose and is at its best only when it is used for that purpose. Of course, you can make a good halftone negative with a positive screen if you use a highlighting or bump exposure (an exposure without the screen) in addition to your regular exposure. Because the screen increases contrast, you can generally eliminate the bump exposure when you use the negative contact screen for shooting negatives; however, you will lose contrast if you attempt to make positives with a negative screen. The gray screen has a built-in bump exposure and it can be used for either color or black-and-white work. Magenta screens cannot be used for copying colored originals in halftone color separation due to the filtering factor of their color.

In addition to the conventional screens just discussed, there is also an elliptical (chain dot) gray contact screen, a round dot screen, and a Respi double dot screen which is available in either gray or magenta. There are also special-effect screens which come in stippled, circle, wavy line, and other patterns. These screens will be discussed later in this chapter.

MAGENTA CONTACT SCREEN

The chances are that most of your work will be done with the Negative Magenta Screen. This screen is a negative made up of vignetted dots in which the gray, silver image is replaced by a dye-coupled magenta image. The size of the dots on the negative is controlled by the amount of light passed by the different zones of each vignetted opening in the screen. Because the magenta-dyed vignetted dots are more transpar-



57.141

Figure 8-13.—Section of a vignetted-dot contact screen.

ent to some colors of light than to others, filters can be used as a factor in contrast control.

Normal copy is generally photographed without a filter; however, if the copy is extremely contrasty, it is possible to shoot it through a yellow (Wratten No. 4) filter to make the highlights and shadows grayer and reduce the overall contrast. The magenta filter (Wratten No. 30) may be used if the copy is extremely flat. When copy is photographed through a magenta filter, the dots in the highlights approach solid white in the final print. Filters are used chiefly for controlling contrast when making film positives.

Screen Position

Contact screens can be used only on cameras equipped with a vacuum back. The screen should be larger than the film so that it will extend beyond the edges of the film and over the channels on the vacuum back. If it is not large enough to do this, you may add strips of clear film or acetate along the margins, carefully joining them to the screen with pressure-sensitive tape so that no wrinkles are formed. (Some cameramen tape the screen over a window cut in the center of a sheet of acetate. The acetate then acts as a frame protecting the edges of the screen.) The screen should be placed over the film, emulsion to emulsion. If a number of exposures are to be made with the same screen, you can reduce handling by fastening the top of the screen to the vacuum back with a strip of masking tape. The sheets of film can then be inserted under the screen as subsequent exposures are made. Some operators use a clean, soft, rubber roller to ensure even contact with the film and to eliminate any wrinkles in the screen. You may also remove wrinkles by placing a piece of paper over the screen and working them out by hand. It is not a good idea to rub the screen directly with your hand. This may scratch the screen and may also charge it with static electricity which will cause it to pick up dust.

Lens Opening

The dot formation is not controlled by the size of the lens opening when the contact screen is used. The f/16 opening is generally used for same-size shots, but you can use any opening down to f/32 with equally satisfactory results. Of course, when enlargements or reductions are to be made, you must change the opening to compensate for the difference in camera extension.

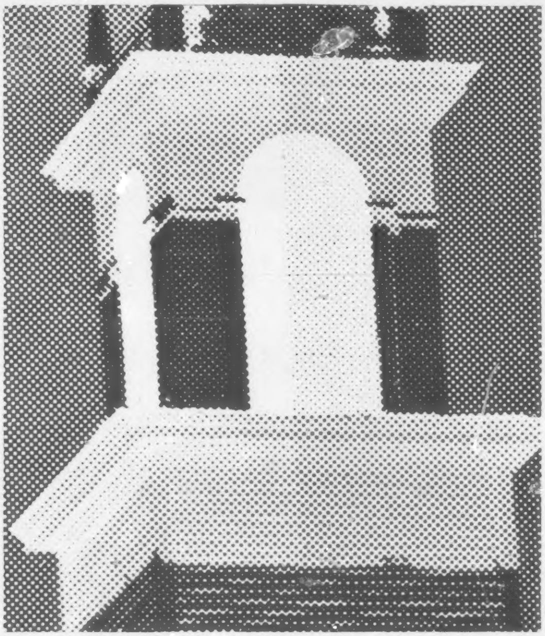
Making the Exposure

You have already seen that you can use filters or a highlight (bump) exposure to control contrast when you are using a magenta screen. You can also control contrast to some degree by varying the period of agitation when the film is in the developer. However, you will find that you can produce the most copy satisfactorily with a detail exposure made with white light (without a filter) and a flash made to yellow light. Yellow light is used for the flash because it produces the smallest and hardest possible dot formation.

To make your main exposure, you simply set the lens for the correct aperture and then make an exposure without a filter for the proper length of time. (See fig. 8-14.) After this, open your camera back and make your flash by exposing the film through the screen directly to a darkroom lamp equipped with a Wratten series 00 (yellow) or OA (yellow green) filter.[3] If a series 00 filter is used, you should use a 7½-watt frosted bulb in the lamp and the lamp should be placed 6 feet from the camera back. (See fig. 8-15.) If the series OA filter is used, you should have a 60-watt frosted bulb in the lamp and the lamp should be placed approximately 6 feet from the camera. The series OA filter does not transmit as much light as the series OO and requires about twice as much exposure to produce the proper shadow dot on the film. The light from the flashing lamp falls on all parts of the film, but since the exposure is of short duration, it does not increase the size of the dots in the middletone and highlight areas. The flash exposure is generally made after the main exposure; however, the exposures can be reversed if desired.

---

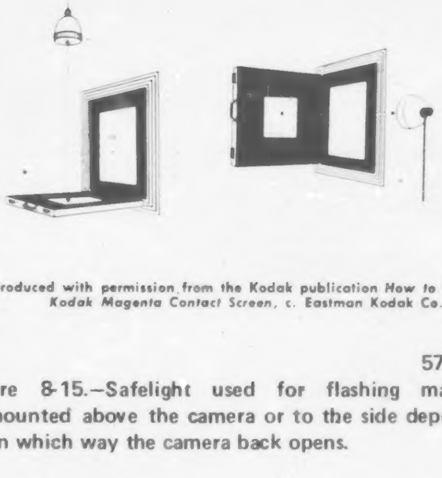
[3] Some cameramen use a green (Wratten No. 58) filter over the safelight when making flash exposures.



Reproduced with permission from the Kodak publication *How to Use the Kodak Magenta Contact Screen*, c. Eastman Kodak Co., 1960.

57.143X

Figure 8-14.—Enlarged section of negative showing how flashing brings out the detail in the shadow areas. Right side received flash; left side did not.



Reproduced with permission from the Kodak publication *How to Use the Kodak Magenta Contact Screen*, c. Eastman Kodak Co., 1960.

57.145X

Figure 8-15.—Safelight used for flashing may be mounted above the camera or to the side depending on which way the camera back opens.

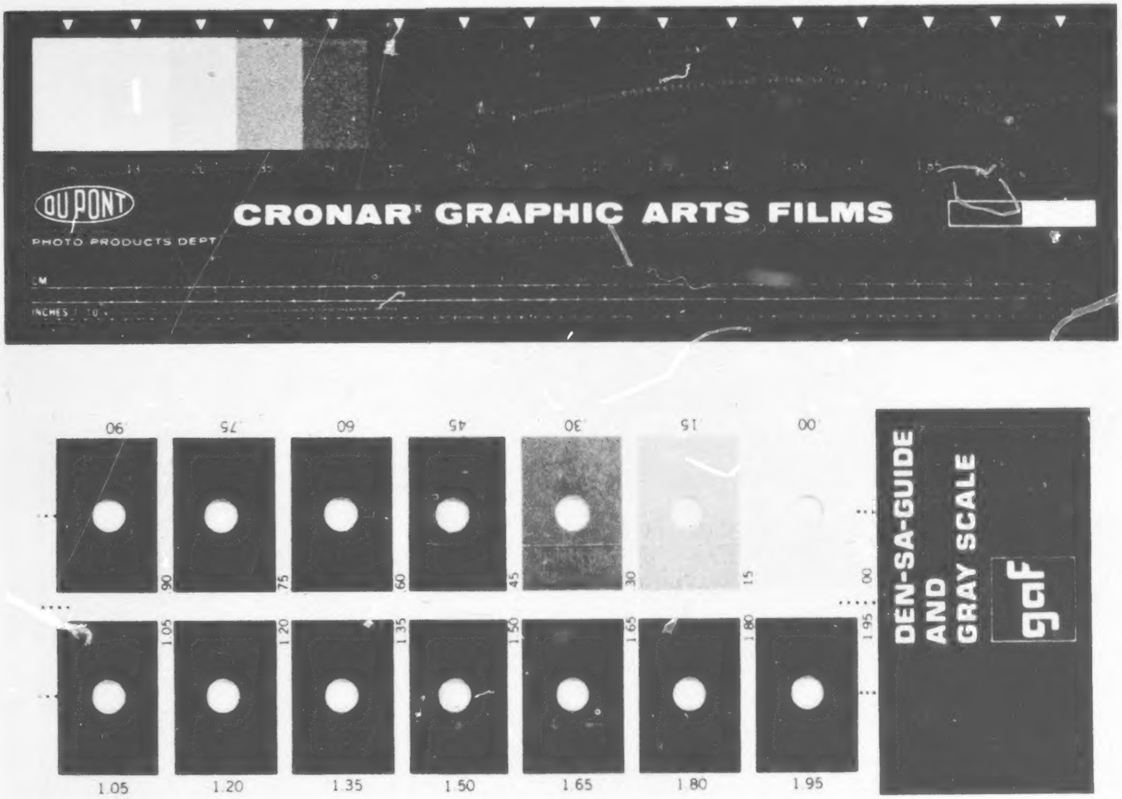
(Flash exposures can also be made with a flashing lamp. If the camera is equipped with such a lamp, the cameraman simply swings it in front of the open lens so that the light will shine into the camera when he is making the flash exposure. Some cameras have an internal flashing light located inside the camera. In this case, the film receives the flash exposure from the internal light while the main exposure is being made through the lens.)

Screen Range

In order to make intelligent exposures, it is necessary for you to know the range of your screen. Some contact screens can produce a greater range of tone than others using the same camera setup. To determine the density range for your particular screen, you should use an f/16 opening and make a same-size halftone shot of a gray scale, like that shown in figure 8-16. (You will notice that each step on the gray scale is marked with a number showing the approximate reflection density of the tone in that particular step. This marking is essentially the same as the reading you would get if you measured the tone with a reflection densitometer.)

Develop the negative in the regular manner and then examine the dot pattern in the exposed areas. You will find that no dots have been formed in some steps of the gray scale, such as the extreme shadow areas. Locate the step on the negative that has a 90 percent highlight dot and the step that has a 10 percent shadow dot and read the densities below these steps. (See fig. 8-16.) If the 90 percent step has a density reading of 0.05 and the step containing the 10 percent shadow dot has a reading of 1.10, you subtract the 0.05 from the 1.10 and you will have 1.05 as the density range of your screen.

As you can see in figure 8-17, a 90 percent highlight dot is almost solid black when the negative is developed. The black dots are so large they overlap or run together and only a small, transparent opening is left between them. The black dots cover 90 percent of the film and the transparent openings between them comprise the other 10 percent. (The openings print as tiny black solids and the remainder of the area prints as white open space when the job is printed.) In



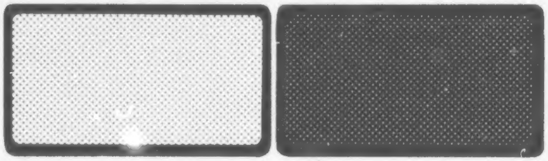
57.183(57C)

Figure 8-16.—Gray scales. If you punch a hole in each step of the scale, you can use it in determining the density range of your copy. To use it for this purpose, move it over a selected highlight or shadow area until the area of the copy visible through the punched hole matches that of one of the steps on the scale. Then note the density reading below the step. This reading approximates the reading you would get if you read the reflection density of the area with a densitometer.

the shadow areas, the cameraman strives for just the opposite. In this case, he uses a 10 percent dot (a small pinpoint dot) covering only 10 percent of the area with the remaining 90 percent of the area as transparent, open space.

The 10 to 90 percent ratio is used because it produces a balanced negative; however, it is not used in all cases. Many of the larger commercial shops use a 95 percent dot in the highlights and a 5 percent dot in the shadows. This ratio is ideal because it provides the smallest printable dots when the job is run. However, if you do not have a densitometer, you may find it a good idea to use the 10-90 percent ratio as a basis for your work because it is difficult to accurately judge a 5 percent dot by eye.

The plate and press characteristics also enter the picture. When the job is run on the press, you would normally expect to have a 5 percent black dot printing in the highlight areas if you had a 95 percent highlight dot on your negative. However, the printing pressure and the ink may increase the size of the dot so that you will have a 10 percent black dot in the highlight areas of



57.593(57C)

Figure 8-17.—Enlarged sections of a negative showing a 90 percent highlight dot and a 10 percent shadow dot. Notice that 90 percent of the area on the right is black while only 10 percent of the area on the left is dark. In large shops, cameramen use a densitometer to measure the dots. This is considerably more accurate than trying to judge them by eye.

the final print. Similarly a 5 percent shadow dot may fill in and be lost completely when it is run on some presses. For this reason, it is a good idea to prepare a test plate and run it on each of your presses to see what size of dot reproduces best under the conditions in your particular shop. There is no use to shoot for a 5 percent shadow dot if the press will not hold it. The paper stock may also affect the dot range. You can use a finer dot if you are printing on a coated stock with a high reflectance quality than you can if you are printing on a soft, porous paper. Some cameramen use a basketball dot (20% to 25% dot) in the shadows, for example, when the job is to be run on newsprint or similar porous stocks.

Study of figure 8-18 will help you to interpret the results of your screen range test exposures.

Density Range of Copy

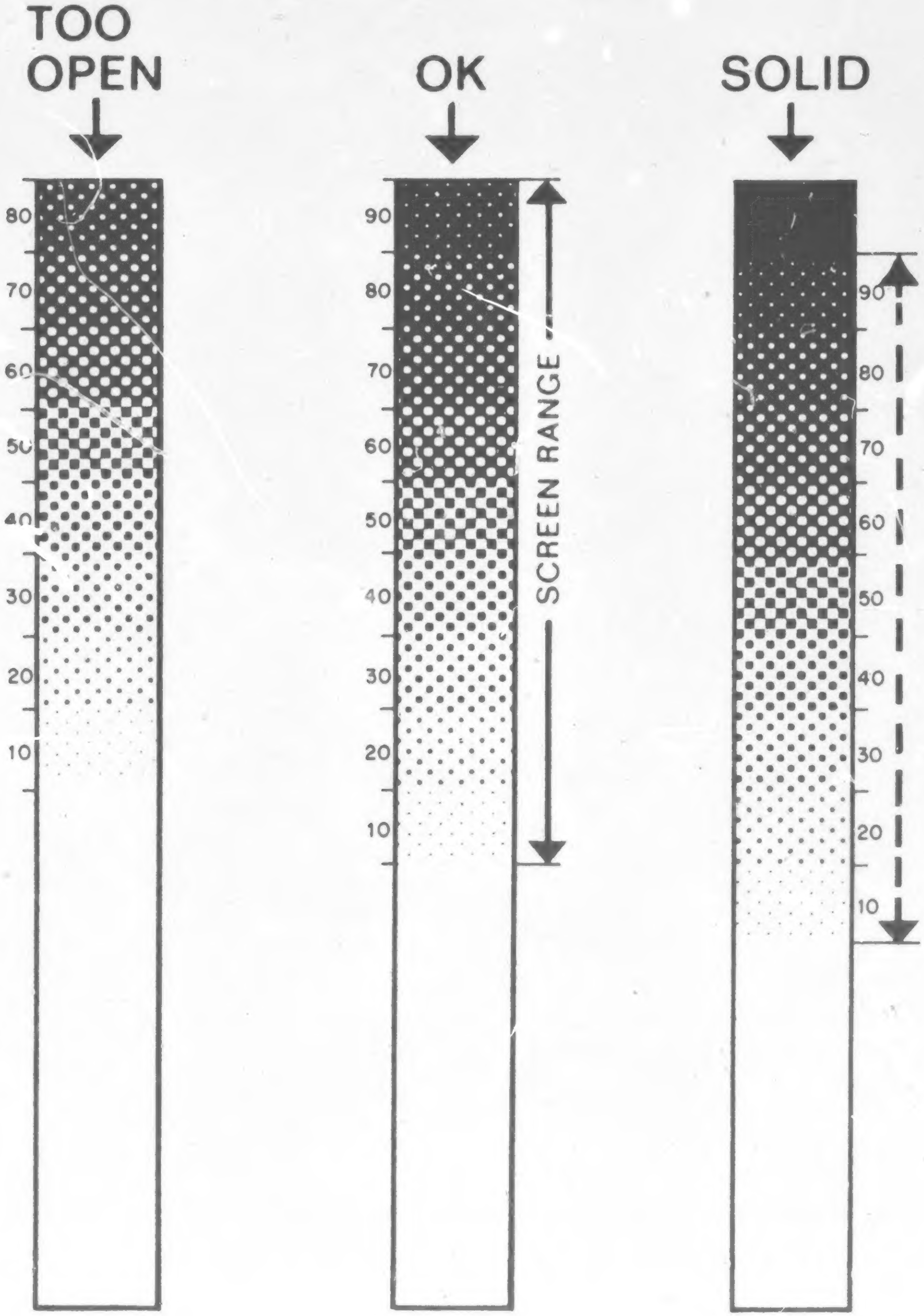
In order to arrive at the correct exposure, it is necessary for you to know the density range of your copy as well as the density range of your screen. Once you have established the density range for your screen, it will not change, but the density range of the copy may vary from one piece to the next.

To find the density range of your copy, subtract the density reading for the highlights from that of the shadows. To do this, select the darkest shadow area in which detail is visible and the brightest highlight containing detail. You can disregard catchlights (negligible highlight areas in which it is unnecessary to hold detail, as in the highlights of the eyes). If all the copy is dark, as in the case of a night scene, use the white margin of your copy for the highlight reading. Once you have selected your highlight and shadow areas move a gray scale, like that shown in figure 8-16 over the copy until the steps on the gray scale match the selected highlight and shadow areas of the copy. (To make comparison easier some gray scales have a hole punched in the center of each step. If your gray scale does not have such holes, you should punch it to provide them.) When the selected area matches one of the steps on the gray scale, note the density reading for that step. Find the density reading for the selected highlight area and then for the selected shadow area and subtract the highlight reading from that of the shadow. This will give you the density range of the copy. (Although density range varies from one piece of copy to another, experience has shown that the average density range for normal copy is 1.60.)

If the intensity range of the copy is the same as that of the screen, you can reproduce it satisfactorily with a single exposure and no flash. If it is less than that of the screen, as might be the case with flat copy, you should use a bump (no screen) exposure to increase the contrast. (This is known as compressing the screen range.) If it is greater than that of the screen, you must use a flash to lengthen the effective range of the screen. The difference between the density range of the screen and that of the copy is known as the excess density. For example, if the density range of the copy is 1.60 and that of the screen is 1.05, you subtract the 1.05 from the 1.60 and you will have 0.55 as the excess density. As you will see later it is necessary to know the excess density for each piece of copy in order to determine the length for your flash exposure.

BASIC EXPOSURES

Exposure times vary with the type of copy, the type of lighting, the type of film, the method of processing the film, the type of screen, and the type of flashing lamp used. To


TOO OPEN
80
70
60
50
40
30
20
10
OK
90
80
70
60
50
40
30
20
10
SCREEN RANGE
SOLID
90
80
70
60
50
40
30
20
10

HALFTONE TESTS

57.720X

Figure 8-18.—To determine the basic density range (BDR) of your screen make a same-size white-light exposure of a gray scale. Try to time your exposure so that the negative will have a 90 percent dot in step one of the scale. If step one contains a smaller dot, you cannot determine the screen range and will have to make another negative. However, if you have a 90 percent dot in step one, two, or beyond, you can determine the screen range satisfactorily, even though step one may fill in and go solid black. (Some cameramen prefer to have step one plug up with the 90 percent dot appearing in the second step so that they can see where the printable dot first appears.) When you shoot a gray scale with a single exposure, you will find when you develop the negative that the screen has produced dots in a certain number of steps on the scale. The number may vary from one screen to another, depending on the manufacturing process and may also vary according to the type of film, shop conditions, and type of development used. If you study the center example shown above, you will find a 90 percent dot in step one and progressively smaller dots in the other steps through step nine. If you increase your exposure the highlight dot will fill in and go solid in step one and the dots in step two will grow to produce a 90 percent dot in that step, as shown in the example on the right. The size of the dots will shift in the other steps too, and you will find that you now have your smallest dot in step ten rather than step nine of the gray scale. But you still have dots in only nine steps because step one has now gone solid. Decreasing your exposure will shift the dots in the other direction, but as you can see in the example shown at the left, it will reduce rather than increase the total number of steps. In other words, this particular screen can produce only nine steps of the scale with a single exposure. Changing the exposure time will move the scale up or down, but will not add more steps. If you make a halftone using only one exposure, you will usually lose some of your shadow detail because your screen range is limited. However, you can use an additional exposure (flash) to extend the screen range in the shadows. When the flash is used, the screen will produce dots in steps ten and beyond, and the longer the exposure (up to a point) the greater will be the number of additional steps it can cover. The flash should affect only the shadow end of the scale; it should not be so long that it will affect the middletones.

determine exposure time, you must first establish a basic time for both the main and flash exposures for your particular setup. This basic exposure is then your starting point. You can vary it as necessary according to the type of copy.

Manual and automatic exposure computers are available for determining the exposures for individual pieces of copy once the basic exposures have been established. If you do not have an exposure computer, you can use the following method for determining your exposures.

Basic Main Exposure

To determine your basic main exposure, you should make a same-size white-light exposure of a gray scale using an f/16 opening and using the film and processing chemicals you will ordinarily be using in your work. Your basic main exposure time will be the exposure time required to put a 90 percent highlight dot in step number 1 (the step with a density reading of 0.00) on the gray scale. This exposure will vary with your camera setup, but it is normally 4 to 7 times as long as you would use if you were shooting the copy as line. (Exposure time varies from one screen to another. A magenta screen usually requires more exposure than a gray screen and a 133-line magenta screen may require more exposure time than a 120-line magenta screen. Exposure time may also vary between two magenta screens of the same screen ruling due to color variation between the two screens.)

You must determine the actual exposure time by trial and error. If examination of the first negative shows that the dots in step one are larger than those shown in figure 8-17, you should make another negative and reduce your exposure slightly. On the other hand, if your dots are smaller and the openings between them are larger, you should make another negative and increase your exposure. After you have made a negative with the proper dot percentage in step one of the gray scale, you can prepare a table, like that shown in figure 8-19 and write in on the table the exposure time used. (This will be your basic exposure time.) In column one of the table, list the numbers (density readings)

1 HIGHLIGHT DENSITY	2 EXPOSURE FACTOR	3 MAIN EXPOSURE TIME (SECONDS)
.00	1.00	18
.05	1.12	20
.10	1.26	23
.13	1.35	24
.15	1.41	25
.20	1.58	28
.25	1.78	33
.30	2.00	36
.35	2.24	40
.40	2.50	45
.45	2.82	50
.50	3.16	56

57.712

Figure 8-19.—Main exposure table. The exposure times listed in column three are included for the purpose of illustrating how the system works. In actual practice you should make a test negative and use the information from it to insert your own set of figures in this column.

shown under each step on your gray scale. In column two write in the exposure factors, as listed in the illustration. (These factors are fixed and will not change.) In column three, list the exposure time required to put a 90 percent dot in each of the density steps listed in column one. To find these exposure times, multiply your basic main exposure by the exposure factor listed for each of the density steps shown in column one and then divide by 1.00 (the factor for the 0.00 density step). For example, if it took 18 seconds to produce a 90 percent highlight dot in step one (the step having a highlight density of 0.00), you should write the 18 seconds in column three on the same line as the 0.00 density. Once this has been done, you can find the exposure required to put a 90 percent dot in the density step marked 0.05 by multiplying the 18 seconds (basic exposure time) by 1.12 (the exposure factor for the 0.05 density step). Then divide by 1.00 (the exposure factor for the 0.00 density step).

18 seconds × 1.12 = 20.16 or 20 seconds
20 ÷ 1.00 = 20 seconds

Write this on the table on the line marked 0.05. You can then find the exposure time required to produce the 90 percent dot in the step marked 0.10 by multiplying the 18 seconds by 1.26 and dividing by 1.00 and so on. Continue until all the blanks in column three are filled in.

Now suppose the lightest step on your gray scale is marked 0.05 in density rather than 0.00 and it takes a 20-second exposure to put a 90 percent dot in this step. In this case, you should record the 20 seconds in column three of the table on the same line as the 0.05 in column one. Once this has been done, you can proceed to fill in the other exposure times in column three. Say, for example, that you want to reproduce your 90 percent dot in the step marked 0.13 instead of the one marked 0.05. In this case, you first multiply your known exposure (20 seconds) by the exposure factor (1.35) opposite the 0.13 on the table. Then divide by the exposure factor (1.12) listed opposite the 0.05 (the original highlight density).

20 seconds × 1.35 = 27 seconds
27 - 1.12 = 24.1 or 24 seconds

(In actual practice this means that you should increase your main exposure to 24 seconds when the highlights of your copy are gray and the brightest area matches the gray scale step marked 0.13.)

You can use this method to determine the exposure for all the other steps on your gray scale and once they have been found, you should list them in column three of the table.

(Your exposure time will vary with enlargements and reductions, of course, and it will also vary if you use an aperture other than f/16.)

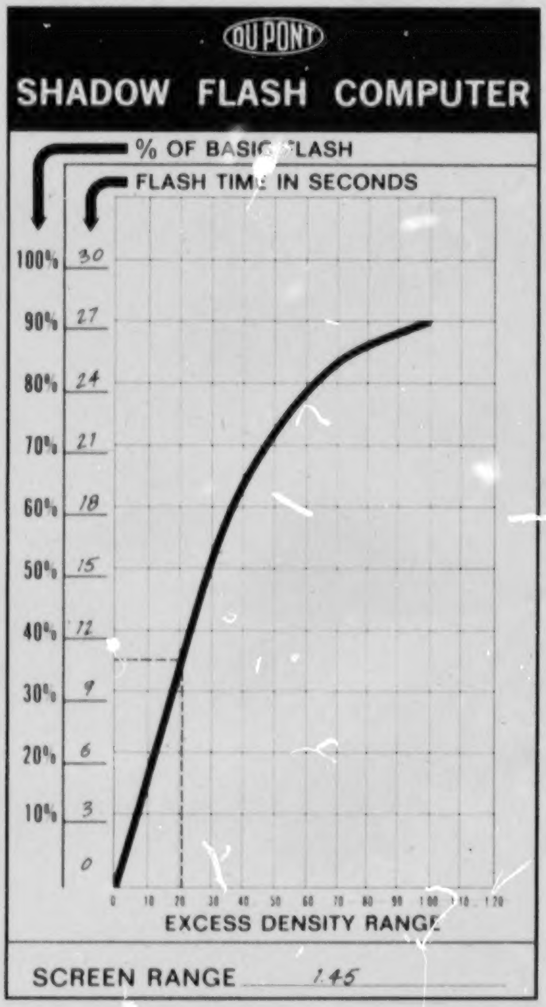
Basic Flash Exposure

You will also have to determine your basic flash exposure experimentally. The basic flash exposure is the time required to produce a 10 percent black dot when a flash (but no main exposure) is given to the film.

To determine your basic flash exposure, open the camera back and make a series of stepped exposures at 5 or 10 second intervals ranging from 10 to 60 seconds. After development check the steps to find out which one gives you the desired 10 percent shadow dot. The time required for producing this step will be your basic flash exposure and it will not change as long as you continue to use that particular type of film and camera setup.

Once you have determined your basic flash exposure, you can use it in computing your actual flash for each job. Your basic flash exposure is the longest flash time that will ever be required. Of course, the flash you actually use when photographing copy will vary from one type of copy to another because the film acquires a partial (threshold) exposure from the copy itself when the main exposure is made and this reduces the amount of time required for the flash. Thus if your basic exposure time is 20 seconds, it may require only 50 percent of the basic exposure, or 10 seconds, to put a 10 percent dot on the film.

You can compute the actual flash exposure time for each piece of copy by using a chart like that shown in figure 8-20, once you know the basic flash exposure and the excess density range. If your basic flash exposure is 30 seconds, write in this figure at the top of column two on the same line as the 100 percent mark. Next compute the flash time in seconds for the other steps in column two by multiplying the 30 seconds by the percentage figure listed for each step in column one. For example, if 30 seconds is required to produce the 100 percent basic flash (30 × 1.00 = 30), then 27 seconds will be required for producing 90 percent of the basic flash (30 × .90 = 27), and 24 seconds will be required for producing 80 percent of the basic flash (30 × .80 = 24). Continue until all the figures have been filled in for column two. You



57.722X

Figure 8-20.—DuPont Shadow Flash Computer. Can be used in determining the flash exposures required for various excess densities. You will notice that the curve flattens at the top. Flash exposures greater than 90 percent of the basic flash exposure tend to create shadow dots which are all the same size and this flattens the negative and causes loss of detail. The figures in column 2 are determined by the basic flash exposure time which your own tests show to be correct. For example if your basic flash exposure was 40 instead of 30 seconds you would write in 40 opposite the 100% on the chart and so on.

are then ready to use the chart for determining your flash exposures.

To use the chart, you must know the density range of your halftone screen. Say, in this case that it is 1.45. Next, determine the density range of the copy to be shot. Say that it is 1.66.

Subtract the density range of the screen from that of the copy and you will have 0.21 which is the excess density range. Locate 0.21 on the base line of the chart and draw a perpendicular line from it up to intersect the curve, as shown in the illustration. At this point, draw a horizontal line to the left edge of the chart. You will notice that the horizontal line intersects the line at the left edge of the chart at the 11 second or 39 percent of the basic flash position. This means that you should use an 11 second flash exposure for this particular piece of copy.

To simplify operations, you may set the chart to make up a table like that shown below showing the flash time required for the excess densities most commonly encountered when you are working. You can then refer to this table to find the proper flash time for copy that falls within this range.

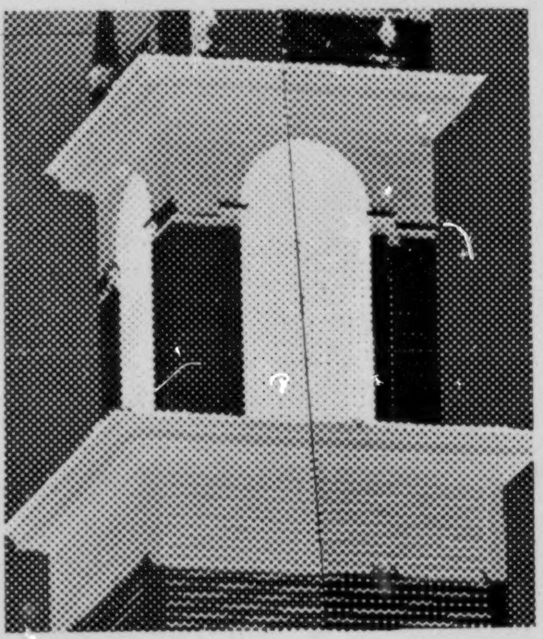
Excess Density	Flash Time
0.05	
0.10	
0.15	
0.20	
0.25	
0.30	
0.35	
0.40	
0.45	
0.50	
Etc.	

Highlight (Bump) Exposure

The negative magenta screen improves the contrast of the copy and has the equivalent of a 7 percent bump exposure built into it. However, on rare occasions, the copy may be such that additional highlight separation is required and a bump exposure will improve the finished product as might be the case, for example, if the copy consisted of a white pitcher against a white table cloth. (See fig. 8-21.) The bump exposure is given in addition to the main exposure. It is essentially a line shot because the halftone screen is removed from the camera when the bump exposure is made.

No bump exposure is needed if the density range of your copy is the same or greater than the density range of your screen. If the density range of your copy is less than that of the screen, you can record the copy (just as it is) without using a bump or a flash. In this case, however, you can improve the appearance of the printed halftone by using a bump exposure to extend the range of the halftone.

Suppose, for example, that your screen range is 1.05 and that your copy is flat and gray, having a highlight density of 0.05 and a shadow density of only 0.09. In this case your copy range is only 0.85 which is less than your screen



Reproduced with permission from the Kodak publication *How to Use the Kodak Magenta Contact Screen*, c. Eastman Kodak Co., 1960.

57.144X

Figure 8-21.—Enlarged section of a negative showing how a bump exposure increases highlight contrast. Right side of negative received bump exposure; left side did not.

range of 1.05, and you can improve the appearance of the printed halftone by using a shorter main exposure than usual to darken the shadows and then giving a bump exposure to open the highlights.

If your shop has an exposure computer, it is a simple matter to calculate the length for the bump exposure. There are also methods for determining the length of the bump exposure mathematically, but they are rather complicated and if cameramen do not have an exposure computer, they usually "estimate" the length of the bump exposure.

The bump exposure may be 2 to 15 percent as long as the main exposure, but it is seldom over 10 percent and the average is 3 to 7 percent. Bump exposures greater than 15 percent of the main exposure are used on occasion, but they may cause fogging of the highlight dots. (The length of the exposure depends on the type of lighting used as well as the copy.)

EFFECT OF THE BUMP EXPOSURE

Percent of the Main Exposure	Screen Compression
2%	0.05
3%	0.10
4%	0.15
5%	0.20
6%	0.25
7%	0.30

When making a bump exposure, mount the film on the camera back, but do not position the screen over it until after you have made your exposure. Use a neutral density (ND) filter (Wratten No. 96, density 1.0) over the lens when you make this exposure if such a filter is available. This filter transmits only 10 percent of the light and makes it easier for you to control your exposure. You must increase your exposure 10 times when using it, of course. For example, if the time for the bump is 2 seconds, you should increase it to 20 seconds when you use the filter.[4] If you do not use the filter, you may be able to reduce your aperture setting on the lens by three full stops and increase your exposure 8 times.

Once you have completed the bump exposure, you should open the camera and position the screen over the film. Then remove the neutral density filter or open the lens aperture and make another exposure for the proper length of time. After this make your flash exposure in the regular manner.

It is simpler to make your bump exposure first followed by the main exposure and flash; however, you can also make it after the main exposure and flash if you prefer. (You should not disturb the film until all the exposures have been made and you should never disturb the screen between the main exposure and the flash.)

The bump exposure changes the size of the highlight dots but does not change the size of the shadow dots. An excessive bump may cause veiling of the highlight dots, however, or cause the highlights to go solid on the negative. For this reason, cameramen often reduce the main exposure by the amount of time used for the bump.

Tone Correction

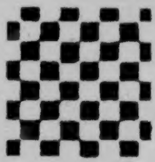
It is difficult to reproduce both ends of the photographic scale accurately. You must either shoot for good highlight separation or for the shadow detail. If you shoot for the highlight detail you compress the screen range and if you shoot for the shadow detail you lengthen it. If the copy is contrasty, you can capture the detail and highlight portions with the main exposure, but you must flash the negative through the screen to provide shadow dots in areas where the copy does not reflect sufficient light. The flash extends the tonal range and also flattens the negative slightly because it increases the size of the dots in the shadow areas.

If you have a flat, grayish print, you may be able to pick up the shadow end of the scale with a shorter detail exposure and then provide additional highlight separation with a bump exposure.

When shooting a halftone,, many cameramen place a gray scale, like one of those shown in figure 8-16, on the copyboard next to the copy so that it will reproduce on the negative. If examination of the copy before the exposure shows that the brightest highlight matches step one on the gray scale and the darkest shadow matches, say, step 10, the operator simply checks for a 90 and 10 percent dot value in these steps as he develops the film rather than searching for the selected highlight and shadow areas on the image proper. If the dot formation is correct in these steps, it usually follows that the middletones will also be correct. However, this is not always the case. For this reason, many cameramen also check for the location of the gray scale step having a 50 percent dot. If you are using a square dot halftone screen, the 50 percent dot (also called the middletone dot) will form a checkerboard pattern as shown in figure 8-22.

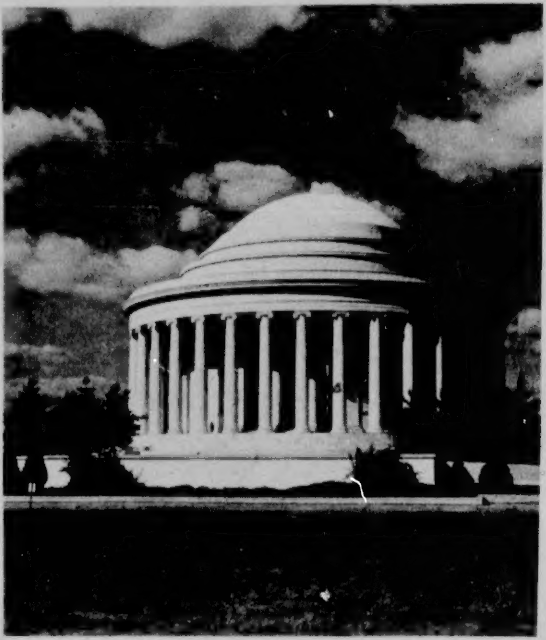
---

[4] Sometimes cameramen use a 1.0 and a 0.3 ND filter together on the lens when giving the film a 5 percent bump exposure. If you use this arrangement, your bump exposure should be the same length of time as your main exposure, because these filters transmit only one-fifth (20%) of the light.



57.120(57C)
Figure 8-22.—When you are using a square dot screen, the 50 percent dot forms a checkerboard design with the corners of the square halftone dots just touching.

The position of the middletone or 50 percent dot on the gray scale determines how the middletones will look in the final print. If you use a gray scale like one of those shown in figure 8-16, the middletone dot will usually fall on a step having a density reading of 0.60 to 0.65 when the 90 percent dot falls in step one and you are trying to duplicate the middletones just as they appear on the original copy. If, on the other hand, the middletones are too dark or too light on your copy and you want to change them on the negative, you can vary your exposure and development procedures to move the 50 percent dot to a higher or lower step on the gray scale.[5] (See figures 8-23 and 8-24.)



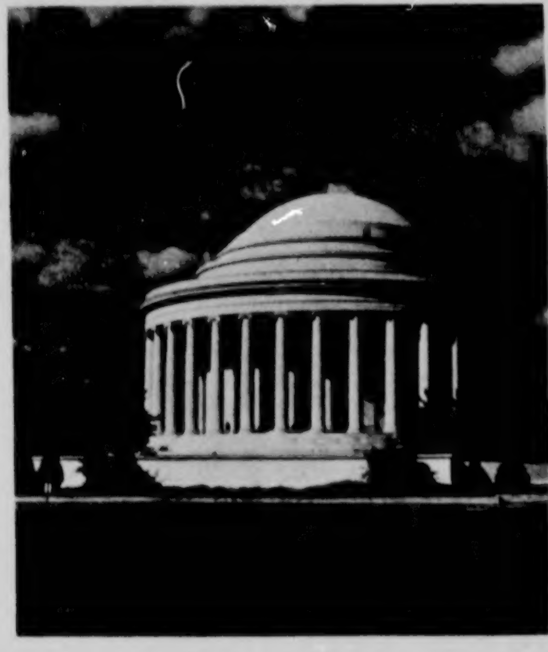
57.723X
Figure 8-23.—Moving the 50 percent dot toward the highlight end of the scale darkens the middletones.

The placement of the 50 percent dot depends on the copy, the paper stock, and whether you want to emphasize the the highlights or the shadows. If the copy is dark and you want the middletones to print lighter on the press, you should lengthen your exposure, use a yellow filter, and/or use no agitation during part of the development period. This will move the 50 percent dot from a lower to a higher density step (farther away from step one on the gray scale). If the copy is too light and you want the middletones to print darker, decrease your main exposure or use a magenta filter or a bump exposure. This will move the 50 percent dot from a higher to a lower density step (closer to step one on the gray scale).

Of course when you change the position of the 50 percent dot, you also shift the position of the dots in the other steps of the gray scale and

---

[5] If you double or halve your exposure time, the dots will move 30 density units up or down the gray scale. For example, if you double your exposure, the 50 percent dot will move from the step marked 0.65 to the step marked 0.95 on the gray scale. Increasing the exposure four times will shift the dot 60 units, and so on.



57.724X

Figure 8-24.—Moving the 50 percent dot toward the shadow end of the scale lightens the middletones.

this affects the contrast of the negative. (See fig. 8-25.) As the 50 percent dot is moved toward step one, for example, the negative tends to lose contrast. You can restore the proper overall contrast in cases where the exposure was shortened by using a bump exposure or varying your flash. You should increase your flash when you reduce your main exposure, because this increases the highlight detail and leaves less detail (more excess density) in the shadows. If your main exposure is shortened too much, the highlight dot may also shift to the point that you will have an 80 percent dot in step one instead of the desired 90 percent dot. In this case, it will be necessary to use a bump exposure to enlarge the highlight dots and get the 90 percent dot back in step one. (The bump exposure tightens the highlights and shortens the distance between the gray scale step containing the 90 percent dot and that containing the 50 percent dot.)

Cameramen sometimes move the middletone dot to the next higher density step to give better shadow detail when they are printing on soft, absorbent stocks, and move it toward the 0.50 density step to give better highlight detail when they are printing on smooth, coated stocks.

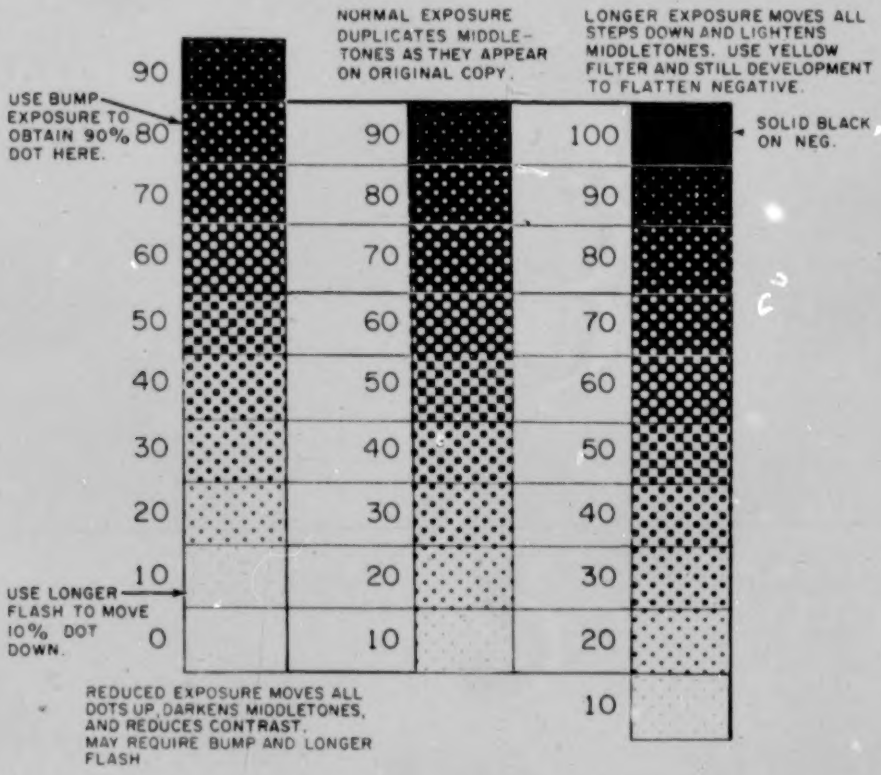
KODAK HALFTONE NEGATIVE COMPUTER

The Eastman Kodak Company produces a device known as the Kodak Halftone Negative Computer, which you can use in accurately determining halftone negative exposures. This computer comes in a package with a set of instructions for its use. It consists of a series of four disks attached to a card in such a manner that they can be spun around. (See fig. 8-26.) Printed outside the dials is a brown ring (A) with a scale representing the densities of the highlight and shadow areas of the copy. The operator rotates the main exposure dial (B) to move the arrow (M) along this scale when he is calibrating the computer or when he is determining his exposures. The basic flash dial (C) is divided into four sections, each representing one of four different basic flash times. The operator rotates this dial until the section corresponding to his basic flash appears in the cutaway area of the mask wheel (D). Tab (E) is used to move the basic main exposure time into window (G) when the computer is being calibrated.

In order to calibrate the computer for your particular camera setup, it is necessary to make a test negative of a 24-step Kodak Reflection Density Guide. (See fig. 8-27.)

To produce the test negative:

1. Set the camera for a same-size shot and use a lens opening that is two stops down from your camera's largest lens opening.
2. Use a strip of the black paper that separates the film in its box to mask off a 1-inch strip along the edge of the film so that it will not be exposed when you make your first exposure.
3. Expose for approximately 30 seconds.
4. After the first exposure uncover the unexposed strip of film and cover the exposed area.
5. Using the camera-back flash technique, make four step flash exposures at 10, 15, 20, and 25 seconds along the unexposed strip.
6. Develop the film for the recommended time.


NORMAL EXPOSURE DUPLICATES MIDDLETONES AS THEY APPEAR ON ORIGINAL COPY.
LONGER EXPOSURE MOVES ALL STEPS DOWN AND LIGHTENS MIDDLETONES. USE YELLOW FILTER AND STILL DEVELOPMENT TO FLATTEN NEGATIVE.
USE BUMP EXPOSURE TO OBTAIN 90% DOT HERE.
SOLID BLACK ON NEG.
90
80
70
60
50
40
30
20
10
0
90
80
70
60
50
40
30
20
10
100
90
80
70
60
50
40
30
20
10
USE LONGER FLASH TO MOVE 10% DOT DOWN.
REDUCED EXPOSURE MOVES ALL DOTS UP, DARKENS MIDDLETONES, AND REDUCES CONTRAST. MAY REQUIRE BUMP AND LONGER FLASH

57.725X

Figure 8-25.—Effects of reducing or lengthening the main exposure.

7. Examine the negative to determine which steps of the gray scale have the correct dot formation. Refer to the instructions supplied with the computer to help you interpret the results of your test negative. You can then use this information in calibrating your computer, following the instructions that come with the computer package.

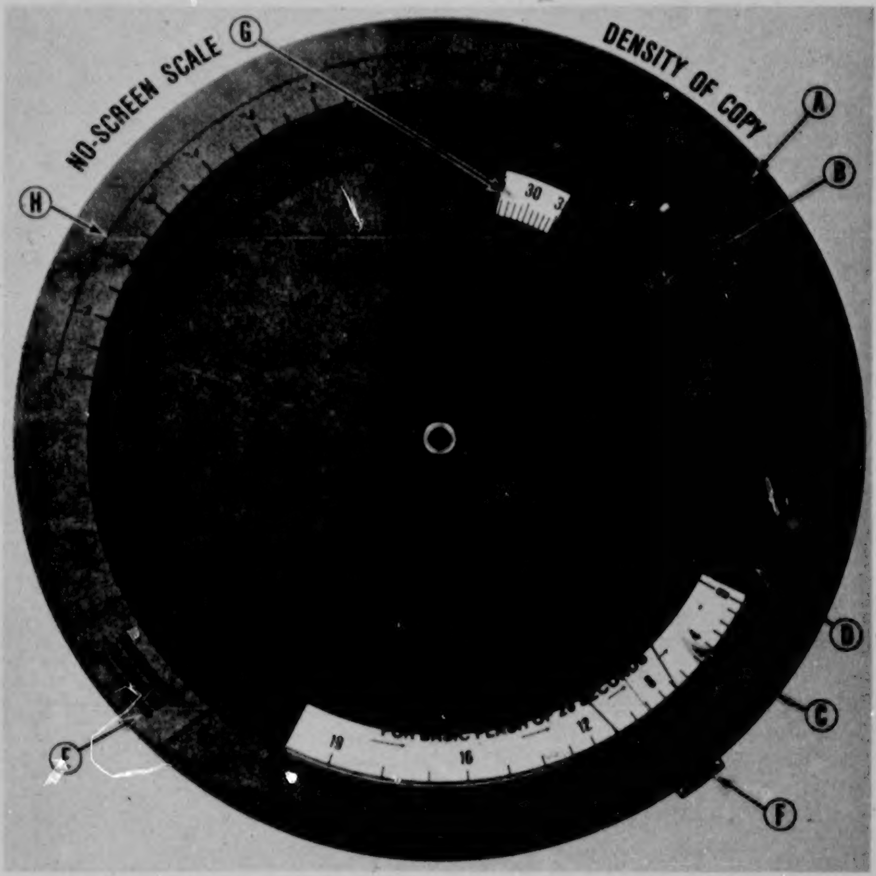
8. Once the computer is calibrated, tape the main exposure calibration tab (E) in place, and fasten the basic flash dial (C), the mask wheel (D), and the main exposure dial (B) together. The computer is then ready for use and you will have a reliable tool to aid you in producing halftone negatives.

To use the halftone computer, measure the highlight and shadow densities of each new piece of copy with a densitometer or a Kodak Reflection Density Guide (gray scale). Rotate Dial (B) until the arrow (M) is pointing to the reading on scale (A) that corresponds to the highlight density of the copy; then look at window (G). The number in this window represents your main exposure time.

Next move the flash pointer (F) to the number on scale (A) that represents the shadow density of your original. The line on the pointer will intersect the number on the flash scale (C) that represents your flash exposure time.

This exposure computer can also be used for determining bump exposures, for making corrections for low-density copy, for moving the middletone (50 percent) dots higher on the scale, and so on. The scale (H) is used for determining bump exposures.

The computer can be used with both magenta and gray contact screens and for making half-

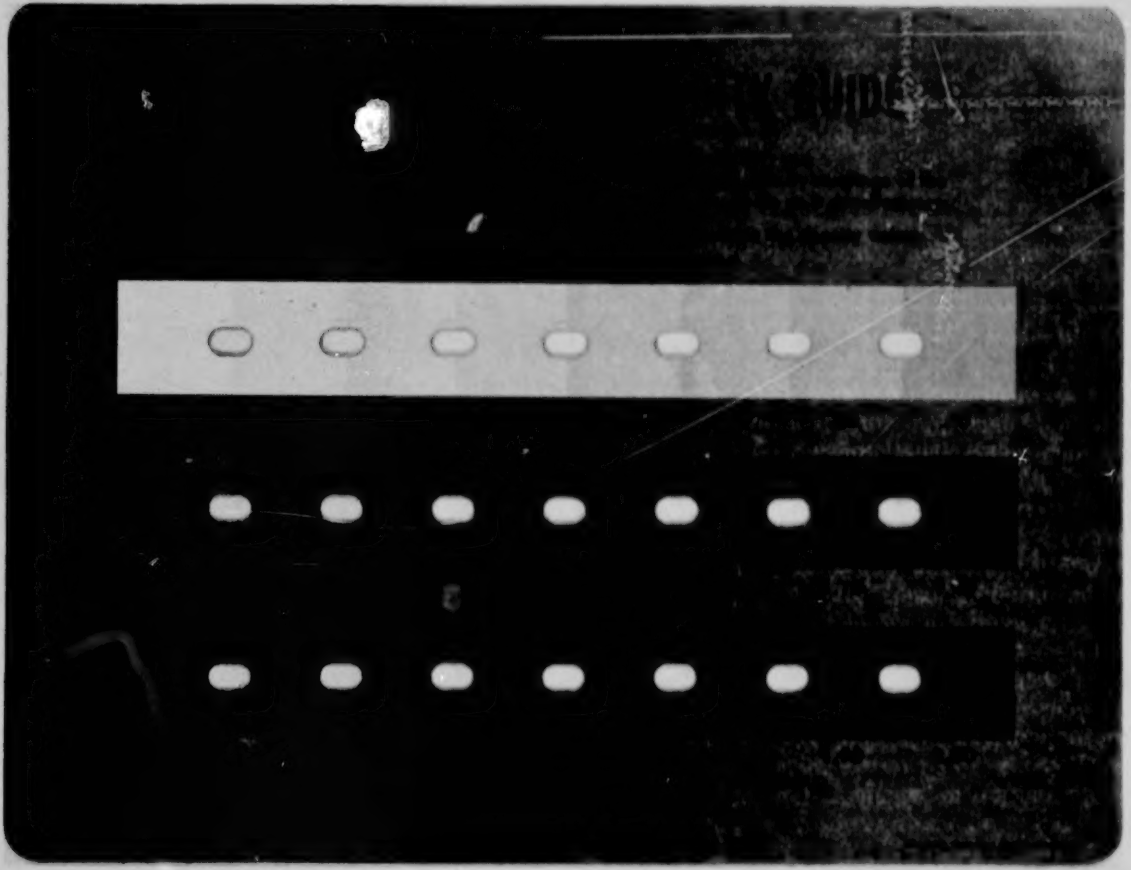


57.726X

A. Copy density guide. The upper right portion of the scale represents the highlight density reading for the copy and the lower right portion represents the density reading for the shadow areas of the copy.
B. Main exposure dial. Turn to move arrow (M) along scale (A) when calibrating the camera or determining exposure time.
C. Basic flash dial. This dial is divided into four sections or scales—one for a basic exposure of 10 seconds; one for 15 seconds; one for 20 seconds; and one for 25 seconds. If the trial negative shows that your basic exposure time is 20 seconds, turn the dial until the 20 second segment of the scale is showing in the cutaway section of the mask wheel (D).
D. Mask wheel. Turn until the right edge alines with the zero on the proper segment of dial (C).
E. Main exposure calibration tab. Rotate until the number corresponding to your basic main exposure appears in window (G) when calibrating the computer.
F. Flash pointer. Move to the number on scale (A) that represents the shadow density of your original when computing the flash.
G. Window
H. Scale used in determining bump exposure.
M. Arrow

Reproduced with permission from a copyrighted Eastman Kodak Company publication

Figure 8-26.—Kodak Halftone Negative Computer.



Reproduced with permission from a copyrighted Eastman Kodak Company publication

57.727X

Figure 8-27.—Twenty-four step Kodak Reflection Density Guide.

tones with Autoscreen film. Autoscreen film will be discussed later in this chapter.

AUTOMATIC EXPOSURE COMPUTERS

In large commercial shops where a great deal of halftone work is done, cameramen make use of a densitometer to determine the range of tones in the copy and the dot range of the negative. They also use an automatic exposure computer for determining their highlight and flash exposures. The densitometer and exposure computer speed up production tremendously and they are very useful in shops where the film is developed by a film processor because the processor develops all film uniformly and the cameraman cannot manipulate development to make allowances of variations in copy and exposure.

Reflection densitometers are used to measure the light reflected from selected highlight and shadow areas of the copy. The cameraman places a probe on the brightest highlights and then on the darkest shadow areas and the reflection density of each area is indicated by a needle on a meter or on a digital readout. Negative densities are measured with a transmission densitometer which measures the light shining through the negative rather than the light reflected from its surface. The density of the halftone dots is known as the integrated tone density because the densitometer reading depends not only on the opacity of the dots, but also on the transparent space between them. The reading for a 10 percent shadow dot is 0.05; the reading for a 90 percent dot is 1.0, and the reading for a 50 percent dot is 0.3.

Exposure computers provide more accurate timing for short exposures than can be accomplished with a regular timer. They also serve as light integrators. That is, they will compensate for such things as faltering arc lights, light bulbs darkening with age, fluctuations in line voltage, and changes in the position of the lamps, by reducing or extending the exposure to allow for such light variations.

In addition, exposure computers automatically compute the main and flash exposures for each piece of copy. They are preset for the density range of the screen and the basic flash exposure. For each piece of copy thereafter, the cameraman turns a dial on a control panel to feed the highlight and shadow density information into the computer. The computer automatically calculates the main and flash exposures, adjusting the flash exposure to compensate for bellows extension[6] and the amount of flare caused by the main exposure. Some computers automatically calculate the highlight (bump) exposure for short range copy and reduce the main exposure accordingly when a bump exposure is required. To make the exposures, the cameraman simply pushes the main, flash, or bump exposure button and the exposure is made automatically.

DEVELOPMENT

The temperature of the developer is particularly important when you are processing halftone negatives. The instruction sheets that are included with each package of film generally recommend that the processing solutions be maintained at 68° F. In such cases, you should keep the processing solutions as near to this as possible, because a variation of 2 degrees is equal to a change of 15 seconds in development time. (See fig. 8-28.) You should check the temperature of your solutions with an accurate thermometer at regular intervals even though you may be using a temperature-controlled sink. Never try to develop film if the temperature of the developer is below 68° F because the developer will not function properly at lower temperatures.

Of course, some films made for use with film processors can be developed in solutions with temperatures up to 90° F. If you are using this type of film, you can maintain your solutions at a higher temperature. The important thing to remember is that once you have decided on the correct temperature, you should maintain it consistently for all your work.

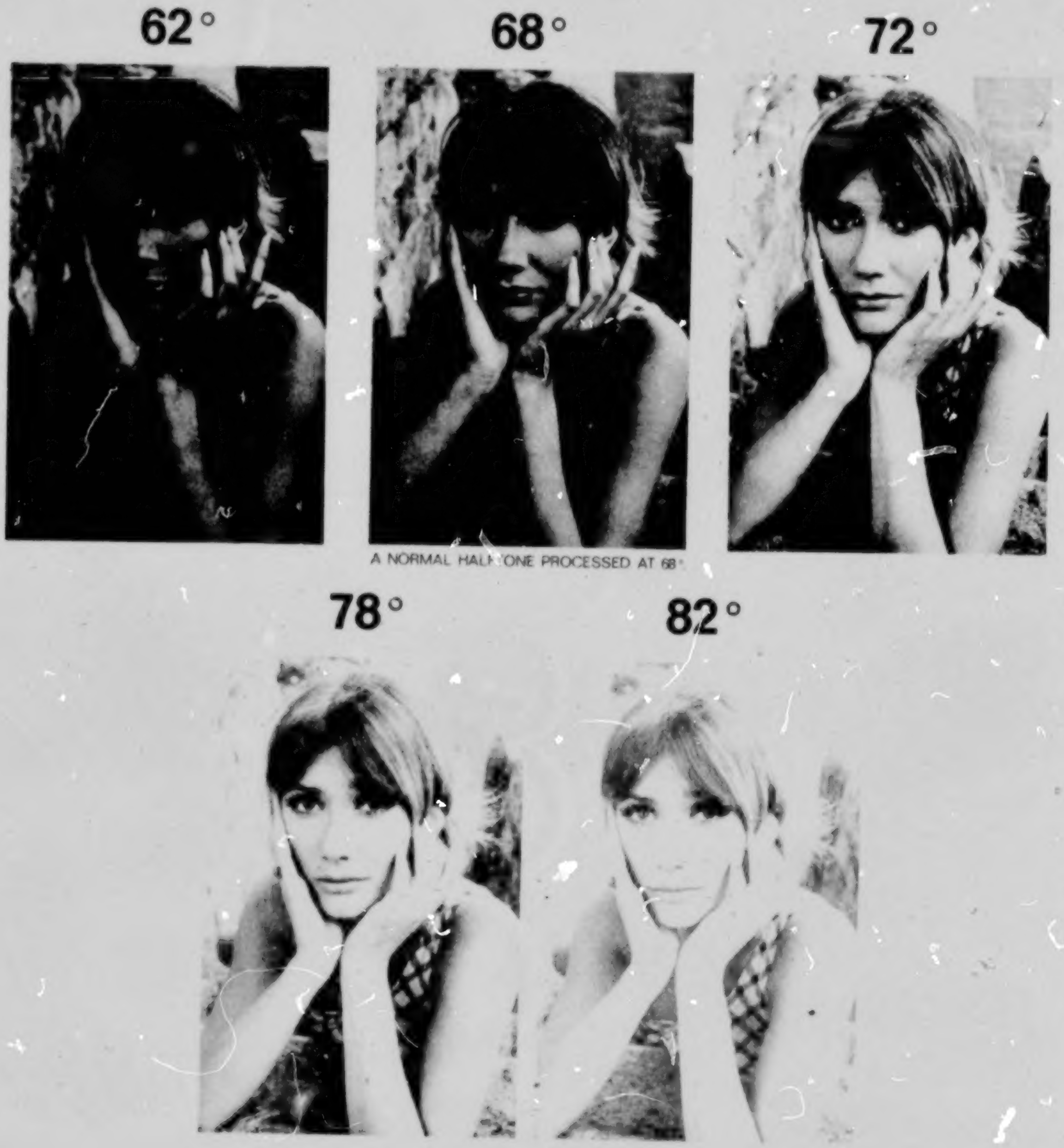
STRENGTH OF DEVELOPER

The strength of the developer is also important. Developers lose strength with use, age, oxidation, and contamination. You should follow the directions on the containers carefully when you are mixing your processing chemicals. Since developers lose strength rapidly with use, most cameramen change to new developer after processing every 5 to 15 negatives (depending on the size of the film, the exposed area, and the amount of processing solution held in the tray). You may find that it is necessary to extend development time slightly as the solution starts to lose its strength[7] and you should allow for this if you are developing by the time-temperature method. You may also wish to vary your exposure or extend development in order to keep from placing fresh developer in the tray near the end of the day.

---

[6] It is necessary to allow for camera extension when an internal flashing lamp is used or when the flash is made through the camera lens.

[7] As the developer loses its strength, it will be increasingly difficult to bring up the proper shadow dots, even though the highlights may still look alright.


62°
68°
72°
A NORMAL HALFTONE PROCESSED AT 68°
78°
82°

57.728X

Figure 8-28.—How the temperature of the developer affects the contrast of the halftone. The same exposure and development time was used in each instance, but the temperature of the developer varied.

DEVELOPING TIME

Developing time affects the quality of the dots and the range of tones in your negative. Average developing time is about 2½ to 2¾ minutes; however, it may vary slightly according to the type of film you are using, so you should use the time recommended for your particular film and developer. Of course, when you are developing by hand, you can vary the development time if necessary to compensate for variations in exposure and exhausted developer. (See fig. 8-29.)

When film processors are used, contrast is controlled largely through proper exposure, and development of the negative is mechanical. Many operators follow this technique for all work, even if their shop is not equipped with a processor. If contrast is controlled through exposure, it is possible for the cameraman to develop a machine-like technique that will provide consistent results for all negatives.

AGITATION

Agitation affects the contrast of the halftone negative. Rapid agitation increases the size of the highlight dots and provides greater contrast and still development increases the size of the shadow dots and reduces the contrast. (See fig. 8-30.) You should develop the film with normal agitation in most instances, but there may be cases (as when a bump exposure is used) that still development will be required to keep the highlight areas from plugging up. In these cases, you should agitate the developer for the first few seconds; then stop all agitation during the last minute of development. This method (called still development) produces open highlights and larger shadow dots, reducing the overall negative contrast. It also brings out extremely fine detail in the negative.

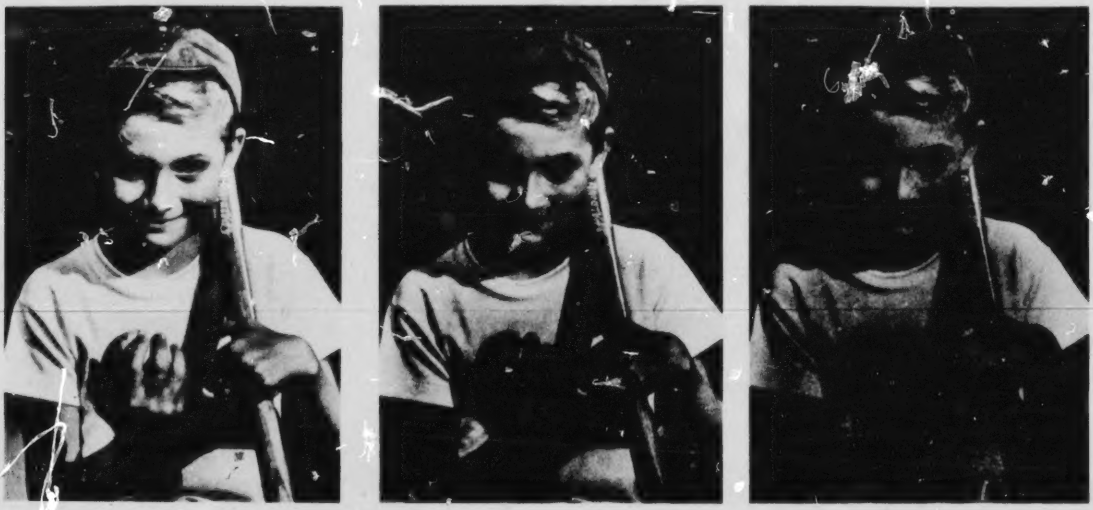
DEVELOPING BY INSPECTION

Occasionally it may be desirable to develop the film by inspection because of variable factors such as the diminishing strength of the developer and small light variations during exposure. Halftones are more critical than line negatives. If it is necessary to make a detailed examination of a halftone during development you should stop the action of the developer while you make the inspection by rinsing the film in fresh water or a mild stop bath (acetic acid solution). The acid rinse will stop the developing action more abruptly than fresh water, but if you use a stop bath, the film must be rinsed in fresh water before it is returned to the developer. If the acetic acid is not removed, it will weaken the developer and may cause underdevelopment in certain areas of the film.

It is not necessary to rinse the film in water or the stop bath if you keep your examination of the negative brief. However, you should know where the highlight and shadow areas are located on the film so that you will not lose time looking for them. It is a good idea to make a mental note of the location of these areas on the copy before you make your exposure and then try to associate them with the corresponding areas on the negative. This may not work, of course, if you make several exposures at once and then process the negatives in a group.

It takes a good deal of experience to be able to check a halftone negative properly. In general you should watch the overall contrast between the brightest highlights and the shadow areas, looking for detail in clothing and highlights in the hair or other suitable areas. You should also check to see that the highlight dots are joined together with a small, round opening in the center; that there is a square middleton dot; and that there is a 10 percent pinpoint dot in the shadow areas. If you shoot a gray scale along with your copy, it will simplify this procedure because you can then simply check for the correct halftone dots in selected steps of the gray scale.

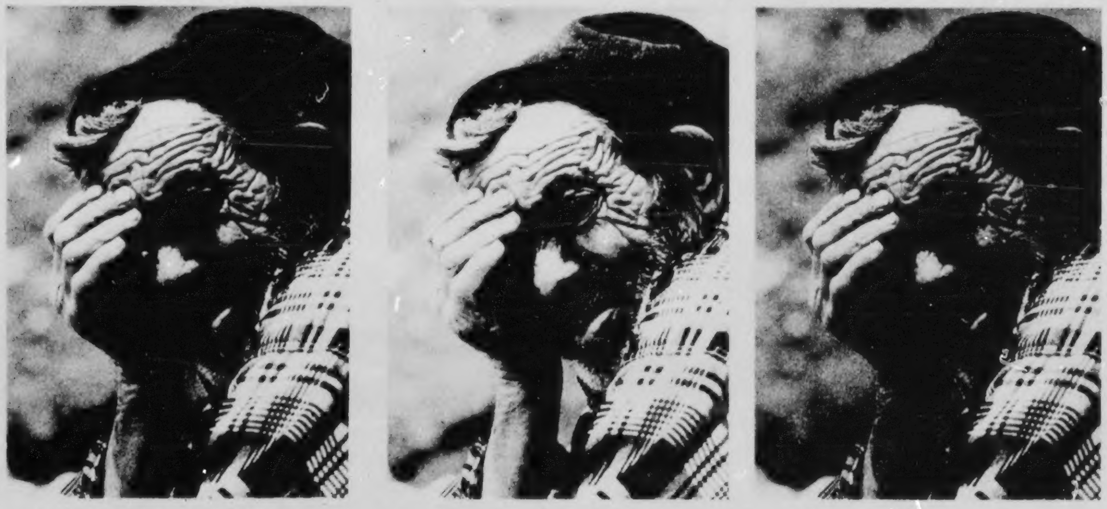
Beware of false highlights. During development it may look as if you have a 90 percent dot in the highlights, but you may find when the negative comes out of the hypo that you have only an 80 percent dot. This will print a 20 percent dot in the highlights when the job is run and you will have a flat print.



1st SHEET 7th SHEET 15th SHEET

57.729X

Figure 8-29.—Illustration showing the effect of exhausted developer on negative quality.



NORMAL AGITATION BRISK AGITATION STILL DEVELOPMENT

57.703X

Figure 8-30.—How agitation affects contrast. The same exposure and development time was used in each instance, but the amount of agitation was varied during the development period.

You can make your inspection by looking at the negative with a 10-power magnifying glass while you hold it up in front of the safelight. If the magnifier is held too close to the film emulsion, however, heat from your hand may cause overdevelopment in areas of the film. If your shop is equipped with a viewing device attached to the developing sink, you can lay the negative on the glass top of this device when you make your inspection.

If your inspection of the negative indicates that the shadow areas have no opaque dots and there are no transparent dots in the highlights, the negative is too contrasty. This means that you should adjust your flash to increase the size of your shadow dots and reduce your main exposure to regulate the size of your highlight dots. You can regulate the size of the dots to some extent during development, of course, if you see that they are not coming up properly or that they are coming up too fast.

You have just seen that vigorous agitation during the latter part of the development period shortens the tone scale and increases contrast while still development extends the scale and decreases contrast. Once the film has developed to the point where the image becomes visible, vigorous agitation will cause the highlight dots to grow more rapidly than the shadow dots and still development will bring up the shadow dots quicker. Therefore if you find the shadow dots are coming up faster than the highlights, use rapid agitation for the remainder of the development period. If you find the shadow dots are small while the highlights appear to be correct, use still development for the remainder of the period. (Although still development brings up larger shadow dots, they are sometimes weak and may burn out when the plate is exposed.)

Halftone negatives are washed and fixed in the same manner as line negatives. You have already seen how negatives are fixed.

Screened Positives

The color of the screen makes it impossible to use the magenta screen for making direct color separation negatives. However, the positive magenta screen can be used in the process camera or in the vacuum frame for making film positives from continuous-tone separation negatives. When making positives in this manner, cameramen generally omit the flash exposure. They control the contrast of the negatives by varying the length of agitation during development and the use of yellow and magenta filters.

Gray Contact Screens

Although the negative magenta screen is the most commonly used of all contact screens, some cameramen prefer gray screens because they require less exposure time. Gray screens have a built-in bump exposure. They have an average density range of 1.05 as compared to the density range of 1.15 to 1.20 of magenta screens. Since they are more contrasty and have a shorter tonal range than magenta screens, they are slightly more difficult to use.

The gray screen is used for black-and-white halftone negatives and for making direct color separation negatives. It is used much the same as the magenta screen, except that it depends on means other than the use of colored filters for contrast control. As you have just seen, the gray screen has a built-in bump exposure which increases the contrast of the negative in the normal manner. You can also increase the contrast by placing the screen on the vacuum back with the emulsion side out rather than against the film emulsion. A very slight separation between the screen and film emulsion shortens the screen range and heightens the contrast of the negative. You can also control contrast by manipulating the flash exposure to produce the desired dot sizes in the shadow areas, by manipulating the period of agitation during development to control the contrast in the highlight areas, or by making a bump exposure to increase the highlight separation.

In halftone color-separation work, it is necessary for the cameraman to change the angle of the screen for each shot so that the overlapping colored dots will not form a disturbing dot pattern or moire when the job is run on the press. When he is working with the contact screen, the cameraman sometimes angles his copy on the copyboard or he works out an arrangement so that he can mount the screen in a series of predetermined positions on the vacuum back to provide the proper screen angles when making his separation negatives. Some companies manufacture sets consisting of four screens, each having a different screen angle, for use in color-separation work.

Elliptical (Chain Dot) Gray Contact Screens

In addition to the conventional gray contact screen just discussed, there is also an elliptical (chain-dot) gray contact screen which varies slightly from the regular gray contact screen. This screen is designed to produce an elliptical dot in the middletones (40 to 60 percent tone areas). Elliptical dots have an advantage over the conventional square dots. In the 50 percent middletone areas, the square dots join each other at all four corners in a checkerboard pattern, while the elliptical dots join each other at only two corners. (See fig. 8-31.) The square dot produces a rather harsh transition from the highlights to the shadows while the elliptical dot produces a more subtle transition. It is easier to print halftones made with the chain-dot screen because the image does not fill in as readily on the press. The elliptical dot screen also minimizes grain when the original copy has considerable gain showing in the print.

Round Dot Screens

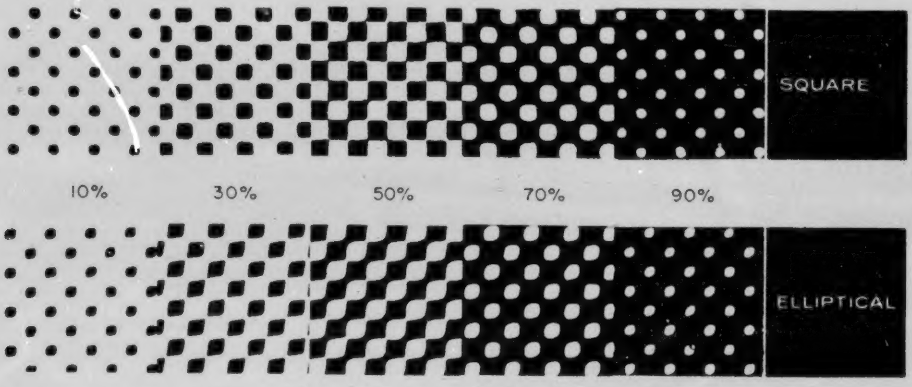
Round dot screens produce round rather than square dots in the middletones. These screens are inherently more contrasty than square dot screens, giving greater contrast control. They also produce shadow detail better than square dot screens. They are available in magenta or gray in a variety of sizes and rulings.

Respi Contact Screens

The Respi screen shown in figure 8-32 is a special type of contact screen. It produces a double dot pattern, like that shown in figure 8-33. This pattern gives better retention of detail and is ideal for halftones which are to be printed on rough or poor quality paper. Because of this special dot pattern, a 100-line ruling is roughly equal to a normal 133-line screen with regard to the retention of detail. Both negative and positive gray and magenta screens are available in either square or elliptical dot patterns. The negative screens have a built-in bump exposure to provide the proper contrast.

Special-Effect Screens

The illustrations shown in figure 8-34 were produced by shooting continuous-tone copy through special effect contact screens. Special-effect screens are available in rulings of 50 lines up. They are similar to regular gray contact screens[8] but are lighter in contrast (more trans-



113.79X

Figure 8-31.—Comparison of conventional and elliptical dot patterns.

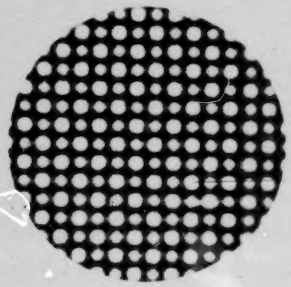
---

[8] Magenta screens are available in some designs. 50- to 65-line screens give the best results in single line work; mezzotint screens give good results in 75-line.

parent) to allow for faster exposure and provide more control in converting continuous-tone originals into line. They are often used for advertising copy and for other types of work where it is desirable to simulate line drawings, engravings, and so on. They are available in a number of different patterns, including wavy line, cross line, steel engraving, etching, contour, circle (which produces an image consisting of concentric circles), and mezzotint (which produces a stippled image).

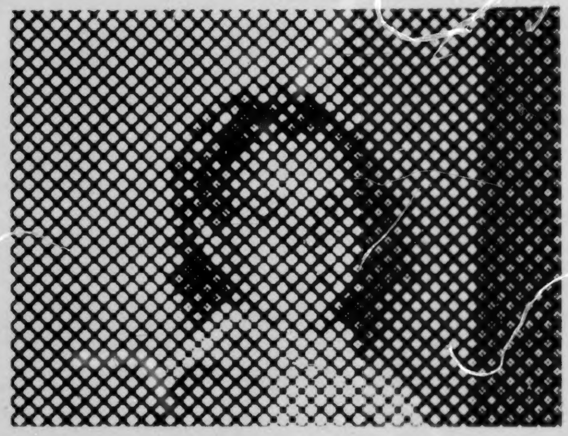
Not every continuous-tone original can be used to advantage with these screens, of course. Best results are obtained when the copy has sufficient contrast to allow the dropping of whites (elimination of dots or lines in the extreme highlight areas) during the exposure.

Figure 8-35 shows how these screens and other techniques may be used to produce striking and unusual results. The illustration in the upper left corner of figure 8-35 is from a regular halftone negative produced from the original copy. The illustration in the upper right corner is the result of a line shot made from the original. (The original was retouched slightly in this case to prevent some of the lighter shadows from dropping out.) The illustration in the lower left corner is the result of photographing the original through a single-line screen. The illustration in the lower right corner was made by first making a highlight or drop-out shot through a single-line screen; then making a photographic print from the negative. After this, a single-line pattern zipatone was applied to sections of the print and it was rephotographed as line.



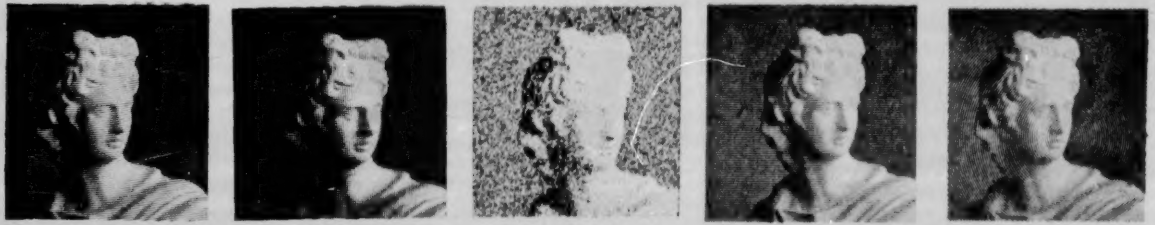
57.595

Figure 8-32.—Cross-section of a Respi Contact Screen.



57.596

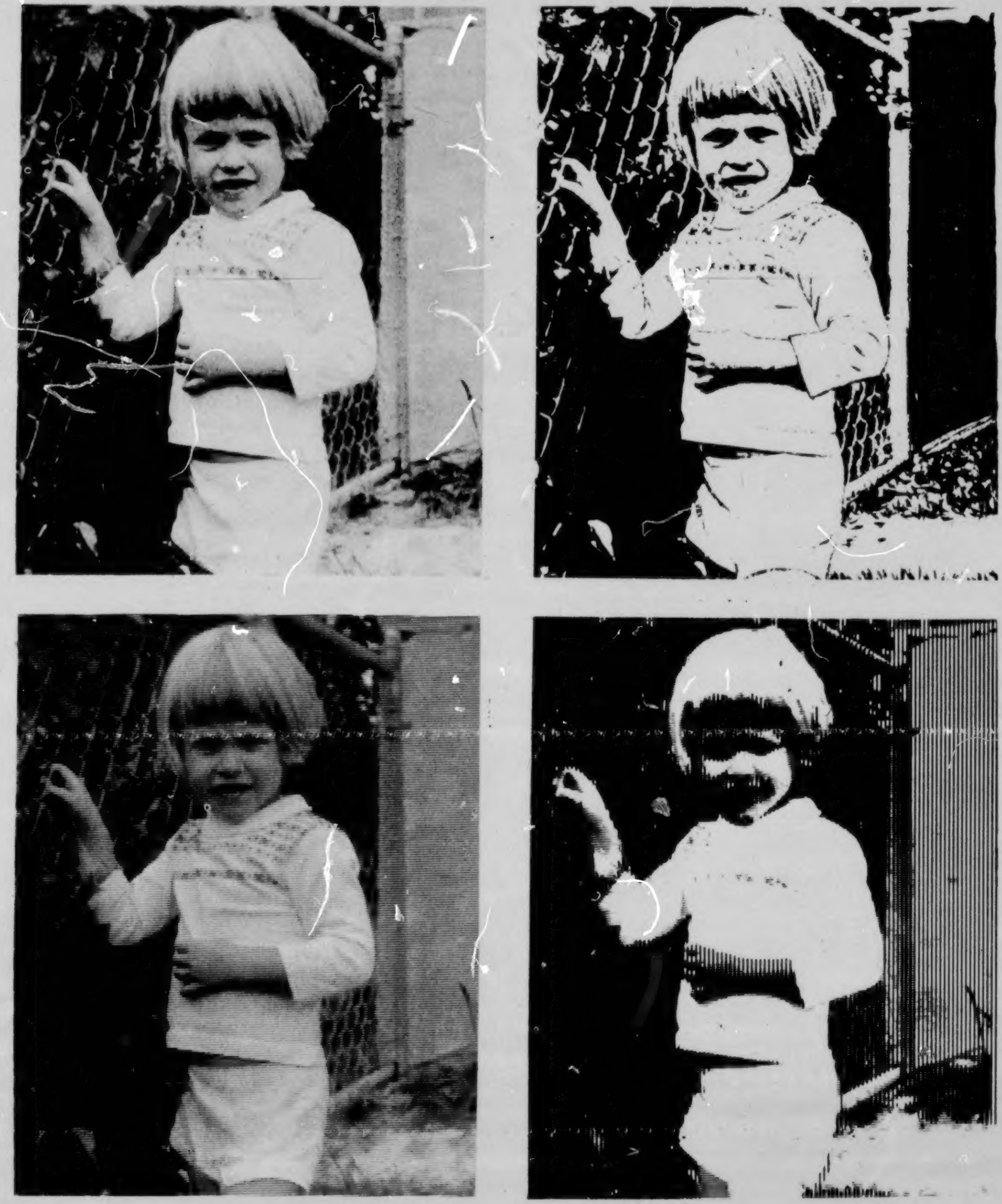
Figure 8-33.—Magnified section of halftone print showing the double dot pattern produced with a Respi screen.



Wavy Line **Cross-Wavy Line** **Mezzo-Grained** **Single Line** **Concentric Circle**

57.597X

Figure 8-34.—Results produced by copying the same photograph through various special-effect contact screens.



57.598

Figure 8-35.—Effects produced by various copying techniques.

You can produce a similar effect by first placing a single-line screen over the film with the lines running horizontally and exposing for approximately 20 seconds. After this, turn the screen so that the lines are running vertically and make another exposure for about one-third of the time used for the original exposure. This should be followed by a 10 percent bump exposure without the screen.

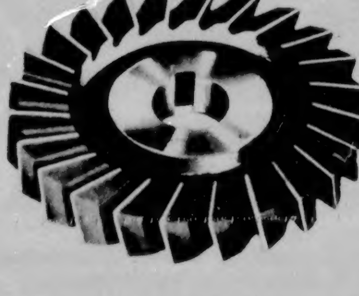
Dropping Out Whites

Sometimes it is desirable to produce halftones which have no dots at all in the highlights or in the white backgrounds. Such negatives are called "dropouts" and produce a more striking print than screened illustrations. They are very popular in such things as catalogs and advertisements. (See fig. 8-36.)

If you are working with a magenta negative screen, you may be able to obtain dropouts by photographing the copy through a magenta filter or using an extreme bump exposure. You can also drop whites by opaquing (painting out) sections of the negative or by using specially prepared masks during copying, as shown in figure 8-37.

COLOR SEPARATION

Halftone color separation, known as full color or process work, is both difficult and expensive. If the copy is to be reproduced in full color, it is necessary to make four separate press plates for it.



28.7(57)

Figure 8-36.—Elimination of gray dots in highlights and background snaps up the appearance of an illustration.

Since colors normally photograph as black or shades of gray, regular black and white halftone negatives are used for color-separation work. In order to separate the colors in the original copy, the cameraman photographs the original through a series of filters.

The negatives are then developed and printed on the offset plates in the usual manner. The original colors are restored when the plates are run on the press in the proper colors of ink.[9] Since impressions from the yellow, red, blue, and black plates must be made on the paper one over the other to restore the full color to the finished print, the cameraman changes the angle of the halftone screen for each shot so that some colors will overlap and some will print side by side, when the plates are run on the press.

For run-of-the-mill work, the operator may be able to get by with three negatives and three plates since most colors can be obtained from combinations of the primary colors, red, yellow, and blue. Overprinting red with yellow produces orange, red and blue make purple, blue and yellow make green, and overlapping all three of the colors gives the effect of black.

Green filters are used for photographing the red in the copy; blue filters are used for the yellow; red filters are used for the blue; and the black may be photographed with a yellow filter or with a combination of filters.

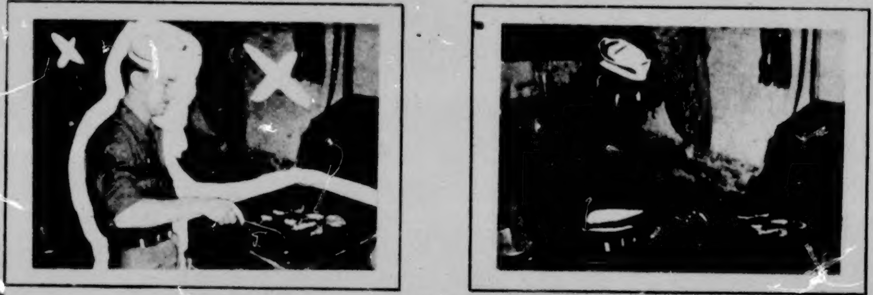
There are two methods of making color-separation negatives. One, known as the "direct method", consists of making a halftone negative for each color directly from the original copy. It is difficult to make negative corrections when the operator is using this method, however. Therefore, many cameramen use another method, called the "indirect method." This consists of first making a continuous-tone negative for each color. From these continuous-tone negatives, continuous-tone positives are made. These

---

[9] Although printers refer to the plates as the "red" plate, "blue" plate and so on, pure red and blue inks are not used in process color printing. Printers have found that they can more closely approximate the colors of the original copy if they use a reddish blue (magenta) and a blue green (cyan) in printing this type of work.

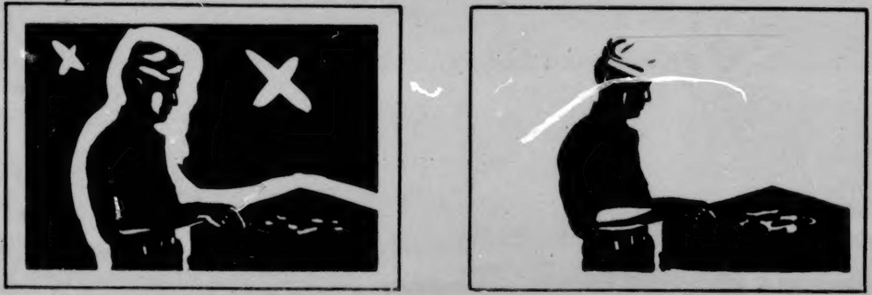
Artist covers photograph or tone drawing with a sheet of clear acetate.

Artist covers photograph or tone drawing with a sheet of clear acetate.



He then outlines the image on the acetate and fills in all highlights to be dropped with chinese white.

Then using black ink, he outlines and fills in on the acetate all parts of the illustration that are to be shot in tone.



The cameraman fastens copy to copyboard to prevent movement, inserts a sheet of black paper between the acetate and the copy, and makes an exposure great enough to burn out all dots in the white sections. Since the areas covered by the black paper reflect no light, the film is not exposed in these areas. The black paper is then removed and a regular halftone exposure is made.

The cameraman fastens copy to copyboard to prevent movement, inserts a sheet of white paper between the acetate and copy, and makes an exposure to burn out all whites as before. He then removes the white paper, folds back the acctate mask and makes a regular halftone exposure.

57.133

Figure 8-37.–Two methods of dropping whites.

continuous-tone positives may be color-corrected if necessary and they are then rephotographed through a halftone screen to produce the final halftone negatives.

An experienced cameraman can often judge the negatives by eye when he is shooting direct separation negatives, but most cameramen photograph a gray scale and standard color blocks along with the original copy. They use this scale for comparing the contrast of the separation negatives. The density is measured with a densitometer. If the contrast and density are not approximately the same on all negatives, the negatives are out of balance and one or more of them must be remade.

At its best, color separation is only about 60 percent accurate. In many cases, the values recorded on the film are out of proportion to the amount of color found in the original. For example, too much red in an area might produce an orange instead of a flesh tint. Therefore, hand corrections on the negatives are generally necessary to correct color values and to prevent colors from cropping up in areas where they are not supposed to be.

Masking

There are also several "masking" methods in use, all of which are designed to reduce the amount of hand corrections or to eliminate them entirely. Masks may consist of thin black-and-white color separation negatives made from a color transparency or they may consist of thin positives made from continuous-tone separation negatives. If a positive is used, it is combined with the original negative and the original and mask are then copied as a film positive. If a negative is used, it is generally combined with the original transparency itself and the two are then copied as a negative.

A color negative made from the original may also be used as a mask. This same-size, negative-image mask is made by contact printing or with an enlarger. The colors on the negative are complementary to or opposite those on the original so that when the mask is combined with the original, the colors act as weak filters bringing up some colors and reducing the strength of others. To provide additional color separation, the original and the mask are combined and four color separation negatives are then made through the proper filters.

Proofs

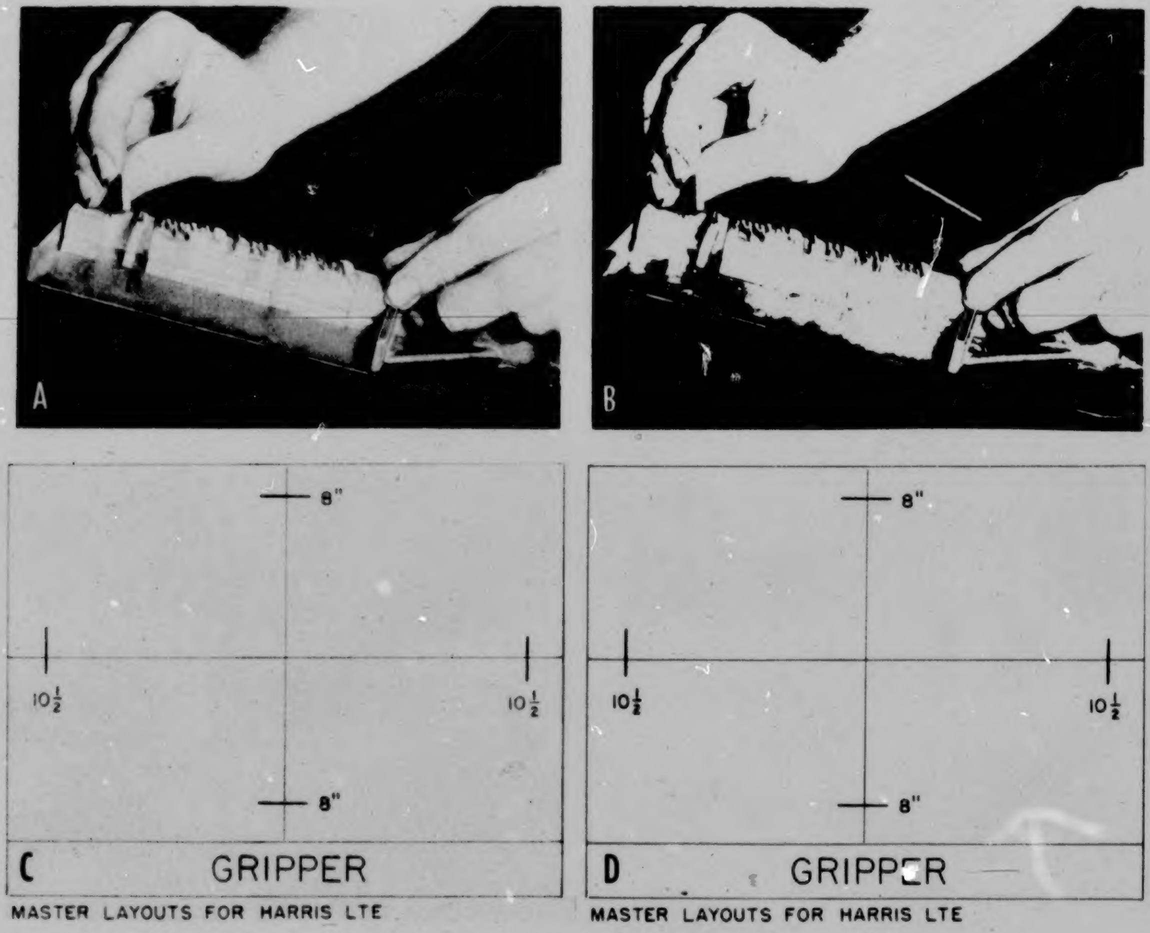
The negatives or positives may be "printed" on offset plates and the plates may then be used for pulling proofs in the proper colors of ink. The resulting set of full-color proofs are known as progressive proofs. By studying them, the operator can tell if the job is satisfactory. If it is not, he must remake or correct the offending negatives, after which a new plate and new proofs must be made.

The 3M Company produces thin, light-sensitive color-coated acetate sheets which may be used in proofing color jobs. The colored coatings on the sheets match standard process colored inks. The sheets are exposed to light through the proper separation negatives and are then developed with a chemical which dissolves the unexposed areas of the coating, leaving a colored image on the acetate. Since the colors are transparent, when sheets with a magenta, cyan, yellow, and black image are registered one over another, a full-color proof results.

Combination Work and Tints

If you will study figure 8-38 for a minute, you will see just what happens when tone copy is shot as line, and you will also see what happens when line copy is photographed through the halftone screen. By comparing the results, you will see that a photograph cannot be reproduced successfully by the line process and a line drawing is not at its best when it is shot as a halftone. In other words, each type of copy must be processed properly if satisfactory results are to be obtained.

But suppose that you receive a piece of copy which consists of a combination of line drawings, type, and photographs. How will you handle this type of copy? If you shoot it as line, the details of the photographs will drop out, and if you screen it, the lines and lettering will lose their sharpness. You can solve this problem in several different ways.



57.134

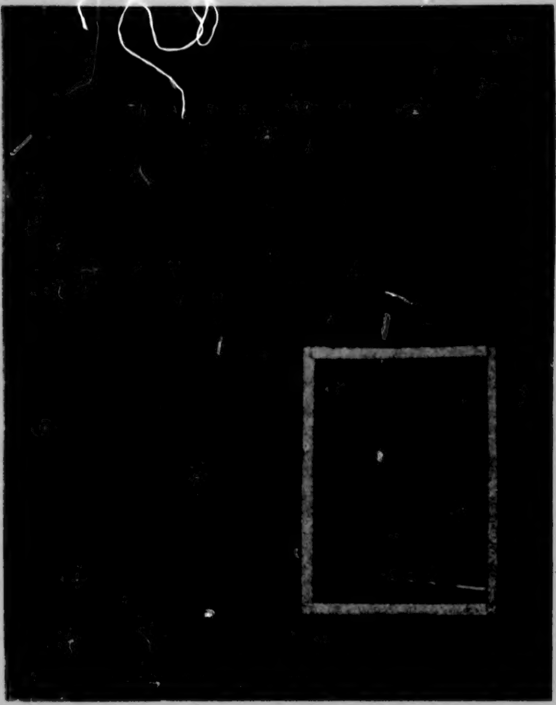
Figure 8-38.—Graphic representation of what happens when tone copy is shot as line and line copy is shot as tone. "A" shows a photograph reproduced properly. "B" shows a line shot of the same photograph. Notice that the print is too contrasty with abrupt breaks between the shadows and highlight areas, and that practically all of the middletones have been lost. "C" shows a screened line drawing. Notice that the lines are soft and feathery. "D" shows the same line drawing properly reproduced.

Splicing Negatives

For example, if the line does not overlap the tone copy, you may simply make two shots of the original—one in line and one in tone. The stripper will then combine the negatives when he strips them together on the flat, laying one over the other and then cutting through both negatives with one cut so that perfect joints are formed. He then removes the portions of the halftone negative from the areas where the line is to appear and removes from the line negative the areas where the tone is to appear and splices the two negatives together. (See fig. 8-39.)

Surprinting

A different procedure may be followed if the line areas overlap the tone portion of the copy. In this case the tone copy should be prepared or



57.135

Figure 8-39.—Line and halftone negatives spliced together for a combination job.

mounted on illustration board, and the line portion should be prepared on an acetate overlay. To photograph the copy, you simply place a sheet of white paper under the acetate and shoot the copy on the acetate as line. Then remove the paper, fold back the acetate, and shoot the tone copy through the halftone screen. It is then up to the stripper and platemaker to combine the printing detail of both negatives by successively printing them on the plate in register.

This procedure is effective only if the line copy is to be printed in black over the halftone area. A different procedure is used when the line areas are to be printed in reverse. That is, white lettering against a dark background.

Reverse Lettering

Reverse lettering over a halftone requires that a film positive be made from the line negative. The film positive must be made as large or larger than the halftone area which it is to cover so that it will not leave a ragged line or shadow when it is printed on the plate. This positive copy is stripped over the halftone negative and printed on the plate with a single printing.

Tints and tone backgrounds can also be stripped over transparent sections of line negatives in this manner. You will learn more about them later in this chapter.

Masking

Figure 8-40 shows how masks are used in combination work. The artist attaches an acetate overlay to the original art and accurately inks in on the acetate all parts to be shot in tone, using a ruling pen and brush. When the tone mask is finished, he folds back the overlay and attaches another sheet of acetate to the drawing. He masks out all line areas on this overlay, extending the masking into the halftone portions of the copy if necessary. Painting in lines that extend into the halftone portions of the copy in this manner is known as "holding them solid." Any area where the line mask overlaps the halftone mask will be reproduced as solid black when the print is made.

After both masks are completed, the copy will be turned over to you. Using the tone mask to cover the tone areas, you should fold back the line mask and make the line shot. Next uncover the tone areas and mask off the line areas while you make the halftone exposure. Since both exposures are made on the same negative, you will than have a combination negative, and the splicing operations described previously will be unnecessary.

TINTS

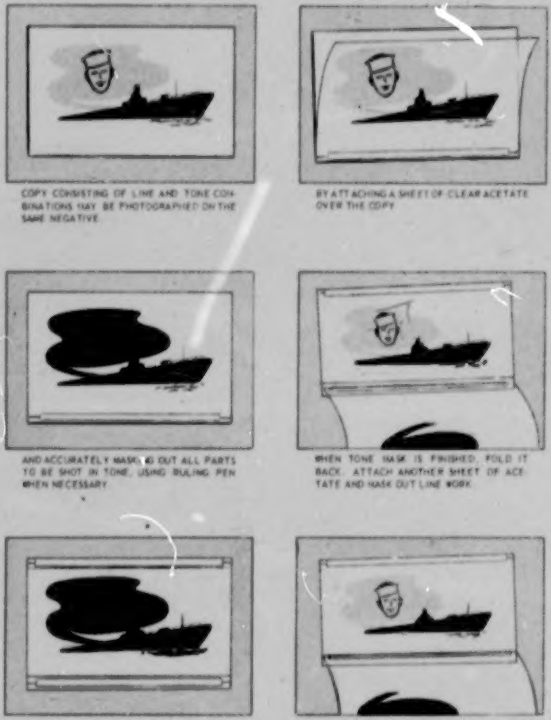
Occasionally you will be asked to supply a tint (benday effect) to the transparent area of a line negative. You can supply the tint by covering the area with an acetate shading sheet of a suitable pattern or you can make screen tints on film by photographing a piece of white paper through the halftone screen. The value (amount of color) of the tint depends on the amount of exposure and the size of the lens aperture used. A quarter tint means that 25 percent of the paper is covered by dots and 75 percent is left as white space. (See fig. 8-41.) A 30 to 50 percent tint is sufficiently strong for most jobs if the work is to be run in dark ink. You can also make tints by using the flashing lamp.

Since it is difficult to produce an even tint in the shop camera due to unevenness in lighting, processing difficulties, and so on, many shops buy film tints sold commercially and use this film when a tint is required. Other shops buy master tint negatives and contact print them on film to produce tints as they are needed. You will learn more about tints in chapter 9 which covers stripping operations.

HALFTONE POSITIVES

You have already seen that positive copies can be made on film by exposure through the negative in the vacuum printing frame, by rephotographing with the camera, or by projection with an enlarger.

In halftone work, reducing or enlarging the image will affect the size of the halftone dot. Therefore, some cameramen prefer to work with continuous-tone positives. These positives may be retouched, enlarged, or reduced as necessary, and may then be copied through the halftone screen to provide the final halftone negatives.



COPY CONSISTING OF LINE AND TONE COMBINATIONS MAY BE PHOTOGRAPHED ON THE SAME NEGATIVE

BY ATTACHING A SHEET OF CLEAR ACETATE OVER THE COPY

AND ACCURATELY MASKING OUT ALL PARTS TO BE SHOT IN TONE, USING RULING PEN WHEN NECESSARY

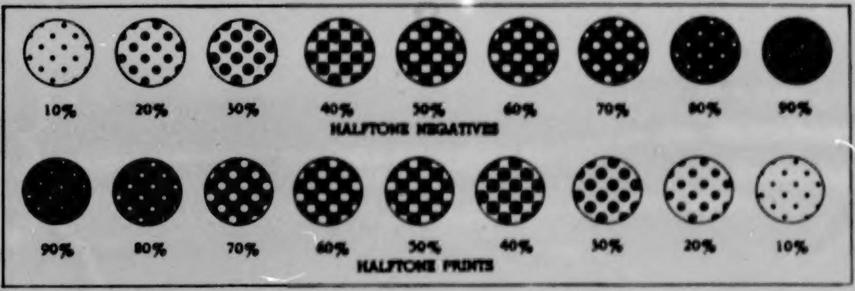
WHEN TONE MASK IS FINISHED, FOLD IT BACK. ATTACH ANOTHER SHEET OF ACETATE AND MASK OUT LINE WORK

THE MASKS ARE THEN OVERLAPPED AND THE COPY IS DELIVERED TO THE CAMERAMAN

WHO COVERS TONE WORK WITH MASK AND COPIES LINE WORK, THEN MASKS OFF LINE WORK AND MAKES HALFTONE EXPOSURE ON SAME NEGATIVE

57.136

Figure 8-40.—Masking for combination line and tone shots. Another method of handling combination work was shown in figure 4-17.



57.137

Figure 8-41.—Halftone tints (enlarged). An 80 percent tint on the negative will yield a 20 percent tint on the plate.

RESCREENING HALFTONES

Occasionally you will have to copy a clipping—a halftone which has been previously printed in a magazine or newspaper. If the screen used for the halftone in the clipping is coarse and open, (not finer than 100 lines per inch), you may shoot the job as a same-size line shot; if it is not, you must copy the job through the halftone screen.

When the job is rescreened, the new dot formation often overlaps the old, and a disturbing pattern called a moire is formed. If the halftone must be rescreened, you can reduce this pattern or eliminate it by reducing the image or by tilting the copy to about a 30° (off vertical) angle on the copyboard. (See fig. 8-42.) Sometimes a screen 50 lines coarser or 50 lines finer than the screen used for the original will eliminate it, but few Navy shops have such a variety of screens.

Rescreener

A diffusion filter, known as a rescreener, is sometimes used over the lens in copying halftone clippings. Since the rescreener diffuses the old dot, the cameraman can use it to make continuous-tone negatives from clippings or he can rescreen the clippings and make halftone negatives without danger of moire.

Warnold Process

You can also produce a continuous-tone negative from a halftone clipping by copying it on Adlux film. Adlux is a slow-speed, continuous-tone emulsion on a frosted-acetate base. It is used primarily for making positive transparencies from continuous-tone negatives. However, it may also be used in the camera as a negative material. When a same-size or slightly reduced shot is made from a 120-line (or finer) halftone clipping, the halftone dots are diffused on the negative to give a continuous-tone effect. The negative can then be enlarged or contact printed on photographic paper and the cameraman can make a halftone negative from this photographic print in the regular manner.

By varying this process you can drop out tone backgrounds on the prints, and you can also improve the contrast of the image in cases where the original clipping is extremely flat.

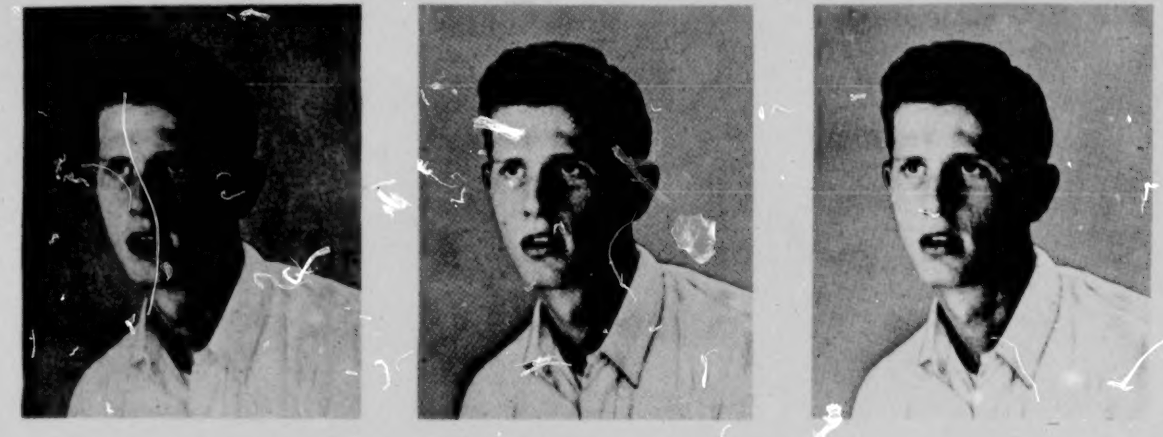
Care of the Contact Screen

Fingerprints, waterspots, and dust will affect the dot formation of contact screens, so you should handle the screen by the edges and you should keep it in a container when it is not in use. You can clean the screen with film cleaner. If dirt is stubborn, immerse the screen in plain water at room temperature or in a solution consisting of 4 ounces of alcohol, 1 cap full of Photo-Flo, and one gallon water. (If the screen is cleaned with plain water, you should treat it with a wetting agent, such as Photo-Flo, before handing it up to dry.) Go over the screen lightly with a piece of saturated cotton to wipe away the stubborn spots. Do not allow the screen to soak more than 5 minutes, because the dye may dissolve and cause streaks if you do. If some of the dye is removed by cleaning, it will alter the filtering factor of the screen and this will affect its performance.

Never use a camel's hair brush on a contact screen; you can dust the screen by wiping it lightly with a piece of photo chamois or by going over it with a Staticmaster brush, which is designed to remove dust particles and eliminate static. If you do not have such a brush, you should tap the edge of the screen lightly against a table top before using it. This will disperse static and eliminate stray dust particles.

Perhaps the worst problem for the cameraman is the half-moon creases that occur when a wrinkle is snapped out of the screen when it is picked up. To prevent these half-moons from forming, you should handle the screen carefully and raise the sides from the diagonal corners to form a kind of roll in the middle as you pick it up.

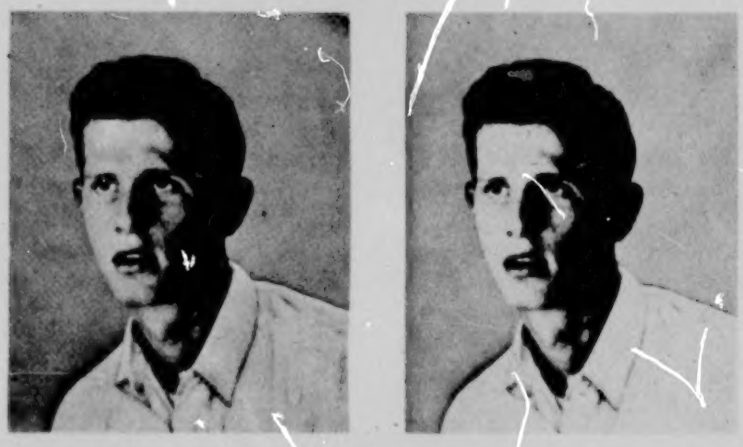
Before handling the screen, you should be sure that your hands are clean and free from all chemicals—even if they are dry. All photographic processing chemicals are harmful to screens; particularly hypo. It can ruin a contact screen in less than a day.



SCREENED CLIPPING

HALFTONE MADE FROM CLIPPING. NOTICE MOIRE CAUSED BY RESCREENING.

HALFTONE FROM SAME CLIPPING. COPY WAS POSITIONED AT 30° ANGLE ON COPYBOARD TO ELIMINATE MOIRE.



HALFTONE FROM SAME CLIPPING. RESCREENER WAS USED IN MAKING NEW NEGATIVE.

HALFTONE FROM PRINT MADE FROM ADLUX NEGATIVE OF CLIPPING.

57.138X

Figure 8-42.—Methods of eliminating moire.

AUTOSCREEN FILM

The Eastman Kodak Company's Kodalith Autoscreen Film, Estar base requires no screen because it has a built-in dot pattern which is imparted to it during the manufacturing process. This dot pattern is produced by tiny variations in sensitivity in the emulsion. All areas of conventional film have equal sensitivity to light, but the emulsion of Autoscreen film is made up of thousands of tiny, light-sensitive areas, each of which is more sensitive in the center than it is around the edges. Consequently when the film is exposed, the light from the shadow areas is so weak that it only affects the center of the sensitive areas and this produces small dots. The middletones reflect more light and are able to expose a larger portion of the sensitive areas. And the reflection from the highlight areas of the copy is great enough to expose all but small areas of the emulsion. The halftone dot size, therefore, is graduated according to the amount of light striking these points of sensitivity on the film.

This film has the ability to produce the same tone scale as the 133-line Kodak Gray Contact Screen, Estar base. It is available in 133-line rulings and in sizes of 4" × 5", 8" × 10", 8½" × 11" and 11" × 14 ". Since no screen is used, less exposure is required for making halftones with this film. It can also produce sharper detail than can be reproduced by other processes.

Making the Exposure

You can make a trial two-step (flash and detail) exposure by mounting a gray scale and a photograph of average contrast on the copyboard and setting the camera for a same-size shot at f/22. If the lighting is supplied by two No. 2 photoflood lamps or two 500-watt 3200 K lamps, position the lamps 3 feet from the copyboard and expose for 30 seconds. If you are using 35-amp arcs or two 1500-watt pulsed xenon lamps, position the lamps 3 feet from the copyboard and expose for 25 seconds. Then open the back of the camera and make a flash exposure of 30 seconds, using a flashing lamp with a Kodak OA filter following a procedure similar to that used in flashing through the contact screen.

Develop the film for 2½ minutes at 68° F with continuous agitation in the same manner as Kodalith film. (Several liquid or powder litho-type developers can be used and tray or machine processing can be employed.) After the negative dries, examine the dot formation. You should have a 90 percent dot in the highlights and a 10 percent or slightly larger dot in the shadows. (See fig. 8-43.) Once you have obtained a satisfactory test negative, you can use it as a basis for subsequent exposures, varying the exposure as necessary for different types of copy. Or you can use the Kodak Halftone Negative Computer shown in figure 8-27 to find the correct exposures for your copy.

SCREENED POLAROID PRINTS

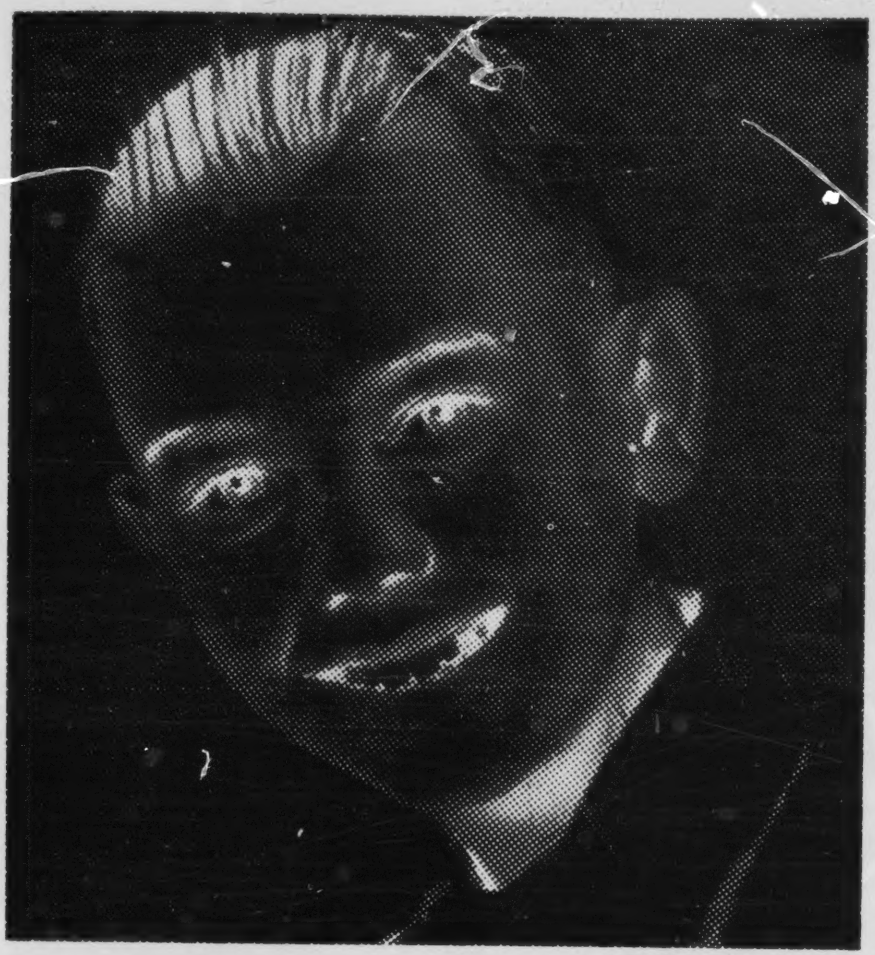
A special halftone screen is available for use in 4" × 5" Polaroid cameras. This screen is placed in the camera so that the light must pass through it on the way to the film. It is held in position by magnets.

The screened photograph may be taken from the camera and mounted on a repro page proof with type matter and line art. The entire page can then be shot as line in the process camera. Screens are available in 65 to 133-line rulings.

PHOTOELECTRIC SCANNERS

Photoelectric scanning machines are a comparatively recent development in the field of printing and lithography. These machines are capable of turning out halftone and line engravings for letterpress printing or positives or negatives for offset work. Some of these machines can be used only for black-and-white work, but others can produce four color-corrected, color-separation plates or negatives in less than 2 hours.

There are several types of electronic scanning machines. The Fairchild Camera and Instrument Corporation introduced the first Scan-A-Graver in 1948. This machine, which is used for producing letterpress engravings operates on the heat principle. The original copy is attached to a revolving cylinder where it is scanned by an electric eye. As the cylinder revolves, the eye



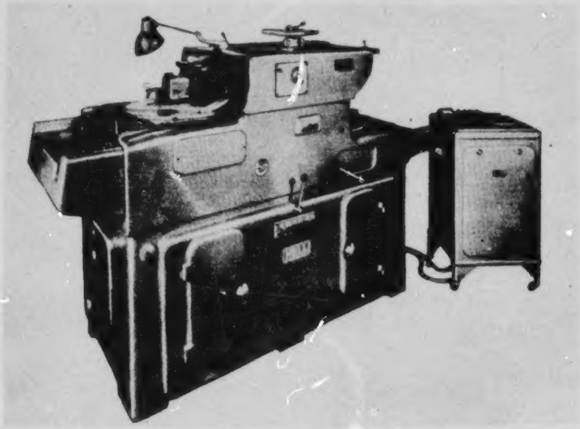
57.146X

Figure 8-43.—Illustration showing dot formation in highlight and shadow areas of Autoscreen negative. (Enlarged)

transmits light impressions to a heated electric needle which burns or engraves the impressions onto a metal or plastic plate. Fairchild later developed the Scan-A-Color machine which produces continuous-tone or screened color-separation positives or negatives on orthchromatic film. (See fig. 8-44.) The film may be used for the preparation of offset plates, letterpress cuts, or photogravure.

Other scanners use variations of these processes. Some scratch a series of lines to produce a halftone effect and others produce a halftone dot with a cold stylus.

Scanning machines are used mainly by newspapers and publishing companies. Black-and-white scanners are particularly useful for small- and medium-sized newspapers which have no photoengraving facilities.



113.103

Figure 8-44.—Scanning machine.

SUMMARY

Halftones are normally made with a glass screen or a contact screen. There are two main types of contact screens: the gray screen and the magenta screen. Most of your work will be done with the magenta screen.

The screen is placed on the vacuum back of the camera in contact with the film emulsion and two exposures are made. The f/16 or f/22 aperture is normally used for the main exposure. This is a white light exposure of the copy. Following the main exposure, the camera back is opened and the film is flashed through the screen by exposure to yellow light. If the copy is very flat, it is sometimes necessary to use an exposure without the screen in addition to the other two exposures. This exposure, called a bump, brings out the highlight detail.

The cameraman usually shoots for a 90 percent dot in the highlights and a 10 percent dot in the darkest shadow areas showing detail. He often shoots a gray scale along with the original copy and watches the dot formation on the gray scale when he develops the film.

Cameramen also check the position of the 50 percent dot on the gray scale. The 50 percent dot normally falls on the gray scale step having a density reading of 0.60 to 0.65, but he can use less exposure, a magenta filter, or a bump exposure to move the dot closer to step one on the gray scale and make the middletones print darker. On the other hand, he can lengthen his exposure, use a yellow filter, and/or no agitation during part of the development period to move the 50 percent dot farther away from step one on the gray scale and make the middletones print lighter.

The temperature and strength of the developer, the length of development, and the amount of agitation used during development affect the appearance of the halftone negative.

Cameramen sometimes use an extended bump exposure to eliminate the dots in the highlight areas entirely when it is desirable to "drop out whites." Highlights can also be opaqued out on the negative to produce the same results.

If copy consists of both line and tone, the cameraman may make separate line and halftone negatives and "double print" them in register on the plate to produce a combined image or he may splice one of the negatives into the other. Masks may also be used to produce combination line and halftone work on a single negative.

When a halftone clipping is shot as original copy, the new dot formation may overlap the old and cause a disturbing pattern called a moire. To eliminate or reduce moire, cameramen may shoot the clipping as line (if the screen is not finer than 100 lines per inch.) Or they may angle the copy about 30° off vertical on the copyboard when the exposure is made. A device known as a rescreener may also be used to eliminate moire. (See table 8-1 for halftone negative difficulties.)

Autoscreen film has a screen pattern imparted to it during the manufacturing process. It is designed to produce a screened image from continuous tone copy without the use of a halftone screen. It requires a white light main exposure and a flash to yellow light. It is not possible to use a bump exposure with this type of film.

TABLE 8-1.–Halftone Negative Difficulties

Difficulty	Cause	Remedy
1. Image develops too slow.	a. Negative underexposed	Check lens diaphragm opening and coverage of lamps. Allow for filter factor, color of background, and halftone screen. Increase exposure time as necessary.
	b. Developer cold	Process at 68° F (20° C).
	c. Developer too weak or too old	Change to fresh developer
2. Negative lacks density	a. Underexposure	See item 1a above
	b. Underdevelopment	Process for recommended time. Increase development time if necessary.
3. Negative thin in corners	a. Illumination not uniform	Increase distance of lights to copy. Use diffusers, or improvise large white cardboard reflectors below and above copyboard to reflect light onto edges of copy.
4. Too much contrast		
a. General	a. Film overexposed	Decrease main exposure.
	b. Bump exposure too long.	Decrease bump exposure time or eliminate.
	c. Developer too harsh	Check solution with an exposed test strip of film. If developer is overactive, dilute it slightly or replace it.
	d. Developer too hot	Keep developing solution at recommended temperature. Cool, if necessary.
	e. Film overdeveloped	Reduce development time.
	f. Insufficient flash	Increase flash exposure or use still development to bring up larger shadow dots.
	g. Too much agitation during development	Use still development during latter stages of development period.
	h. Copy too contrasty	Make all or part of main exposure through a yellow filter or use still development. Increase flash exposure.
b. Highlight dots too large; shadows OK	a. Main exposure too long	Reduce time for main exposure

Table 8-1.—Halftone Negative Difficulties—Continued

Difficulty	Cause	Remedy
	b. Bump exposure too long	Decrease time for bump exposure or deduct time required for bump from time used for main exposure. Or eliminate bump.
	c. Film overdeveloped	Reduce development time and/or use still development.
	d. Developer too harsh or to hot	Cool or dilute with used developer. Shorten development time if necessary.
c. Shadow dots weak; highlight dots OK	a. Insufficient flash	Increase flash exposure or use still development to bring up larger shadow dots.
5. Not enough contrast		
a. General	a. Main exposure too short	Increase main exposure to provide proper highlight dots.
	b. Original copy too flat	Make all or part of main exposure through a magenta filter or use a bump exposure. Use agitation during entire development period. Place screen on vacuum-back with emulsion side facing lens rather than against the film.
	c. Developer too old or too weak	Try fresh solution. If still development is used increase period of agitation to increase contrast in highlight areas.
	d. Developer too cold	Keep developing solution at the recommended temperature.
	e. Flash exposure too long for flat copy	Decrease flash exposure or use rapid agitation during last minute of development.
	f. Negative underdeveloped or underexposed	If all dots are small and transparent negative was underexposed or underdeveloped.
b. Small highlight dots; shadow dots OK	a. Main exposure too short	If highlight dots are small and fuzzy exposure may have been too short and development forced until fog set in.
c. Shadow dots too large	a. Too much flash exposure	Reduce flash exposure and/or use rapid agitation during the last part of development period.
d. Middletones too flat	a. Incorrect main exposure	Expose to move the 50 percent dot, if necessary.

Table 8-1.–Halftone Negative Difficulties–Continued

Difficulty	Cause	Remedy
	b. Underdevelopment	Develop for the recommended time with solution at proper strength and temperature.
6. Blurred image	a. Camera out of focus	Check image on ground glass. See if copyboard, ground glass, and vacuum back are locked in focusing position. Also check scale readings if camera was positioned to scale. In critical focusing check with lens stopped down to that required for exposure because focal length may vary with change in diaphragm opening. If focal length of lens seems to have altered, have qualified operator check for loose inner and outer elements of lens.
	b. Movement (Vibra- transmitted to camera may blur fine detail.)	Reduce movement around camera to a minimum. Check shock proof mounting. Check rubber inserts.
	c. Other causes are expansion of copy due to heat from lamps in prolonged exposures, shift of lensboard in changing stops, or slippage or lifting of film on vacuum back.	Check each item.
7. Oblong or fuzzy dots	a. Incorrect exposure	Check exposure time.
	b. Film or screen not perfectly flat on vacuum back	Be sure that vacuum back is clean and free from foreign matter, that film and screen are mounted properly, and that wrinkles have been smoothed out.
8. Blotches	a. Screen not contacting film properly	See item 7b above.
9. Pinholes	a. Screen, film, or copyboard glass dusty	Check each before making another exposure.
	b. Airbells	Airbells may prevent developer from contacting film emulsion. Wet film in plain water before immersing it in developer and/or agitate developer to prevent airbells from forming.

Table 8-1.—Halftone Negative Difficulties—Continued

Difficulty	Cause	Remedy
10. Development not uniform	a. Safelights leaking	Faulty safelight filters can cause areas of the film to fog if the film is left lying open for 4 or 5 minutes. Exposed film should be processed immediately or placed in a lightproof box.
	b. Improper inspection procedures	Heat from the cameraman's hand may cause overdeveloped streaks on the negative. Do not get hand too close to film when examining dot formation with a magnifying glass.
	c. Contamination	Fingers or magnifier contaminated with fixer can cause uneven development. Keep hands clean and do not allow magnifier to touch film.
	d. Failure to immerse film evenly when putting it in developer.	Wet film in plain water or draw it through solution face down when putting it in developer.
11. Flare or hot spots on negative	a. Light reflections from copyboard or camera room area	Use black copyboard; check lighting in camera room.
	b. Reflections from copy	Check positions of lamps and light source distance.
	c. Light leak in bellows	Inspect bellows and repair if necessary.

Note: If negatives fog repeatedly without any apparent explanation or cause, you should report the matter to the Damage Control Assistant. The fog may be due to radiation, (x-ray, nuclear, etc.) or to extreme heat.

CHAPTER 9

NEGATIVE CORRECTIONS AND STRIPPING

Before you make a lithographic (offset) plate from negatives or positives, you must assemble them, mount them on some type of support, and correct them as necessary.

Assembly of negatives or positives in proper order, relating them to each other, and attaching them to a support, is an operation referred to as "stripping". Any modifications to negatives or positives are collectively called "corrections". These corrections include deleting unwanted image areas, repairing weak or broken images, and adding rules or lines to the film.

Because the image that is formed on a plate when it is exposed to light through negatives or positives generally cannot be altered, accuracy must be your first concern when you are performing either of these operations. If you make an error when you are stripping or making corrections, it will appear on the plate and more than likely it will also be included in the finished product, the printed page.

Before you begin stripping, carefully check the instructions that accompany the job. Pay particular attention to such things as page margins, page locations relating to each other, and any other information that applies to the printed image on the paper. If any of the instructions are unclear to you, check with your shop supervisor before you begin.

STRIPPING EQUIPMENT AND MATERIALS

As you will see in the next chapter, all offset printing plates are not made the same way. Some are made from film negatives, others are made from film positive. The majority of the plates you will be working with are made from negatives and are known as "negative working plates." These plates carry a positive image that is obtained by exposing them to light through a negative. (Although it is not commonly done, a positive may also be used with negative working plates if you want to obtain a negative image (reverse) on the plate.) Since you will be working with negatives the majority of the time, this chapter will primarily deal with negative stripping procedures.

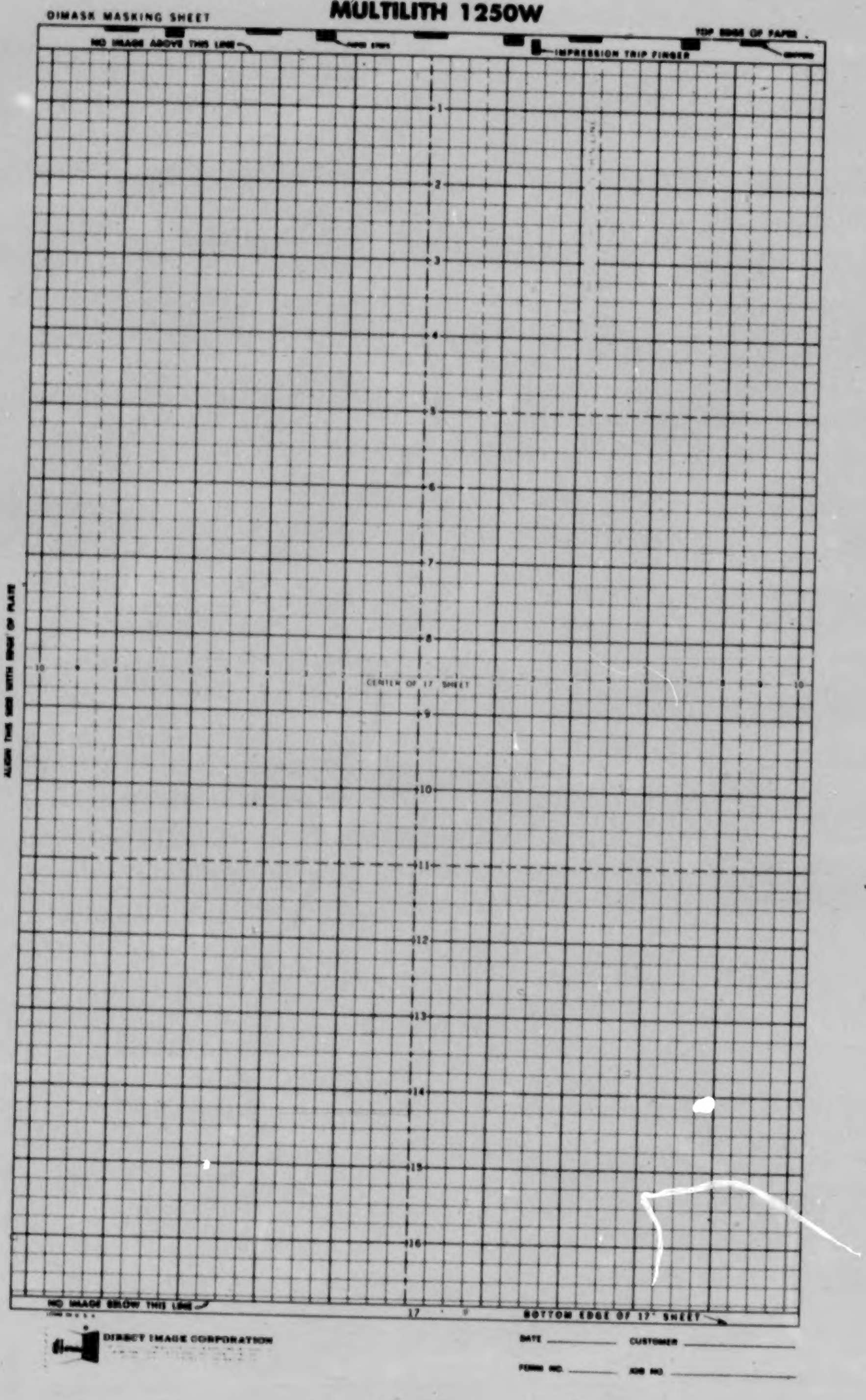
Goldenrod

The material to which you layout and attach the negatives is known as goldenrod. Because of its color, usually yellow or reddish-orange, goldenrod is a mask that prevents light from exposing the non-image areas of the plate. (Negative working plates are colorblind to red and yellow light.)

The type of goldenrod you will normally work with is coated, 80-lb. paper. However, if you are stripping negatives for close register work, acetate can be used instead of paper because of its increased stability. Clear glass or acetate is often used for stripping strip film and color separation negatives and positives in shops that handle that type of work.

In recent years, goldenrod which has been preprinted with grid (guide) lines has come into frequent use for small and medium sized stripping jobs. (See fig. 9-1.) The guide lines on this goldenrod allow you to position the negatives accurately without requiring you to rule-in lines as must be done when you are using plain goldenrod paper. As a further time-saving aid, preprinted goldenrod has other information you will find helpful such as press gripper margins, standard page areas, and centering reference points for various page sizes.

When the goldenrod isn't preprinted, it is necessary to rule-in guide lines on the paper to ensure that the negatives are accurately positioned on it. Later in this chapter you will


DIMASK MASKING SHEET
MULTILITH 1250W
NO IMAGE ABOVE THIS LINE
TOP EDGE OF PAPER
IMPRESSION TRIP FINGER
ALIGN THIS SIDE WITH EDGE OF PLATE
CENTER OF 17" SHEET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
NO IMAGE BELOW THIS LINE
BOTTOM EDGE OF 17" SHEET
DIRECT IMAGE CORPORATION
DATE
CUSTOMER
FORM NO.
JOB NO.

57.731

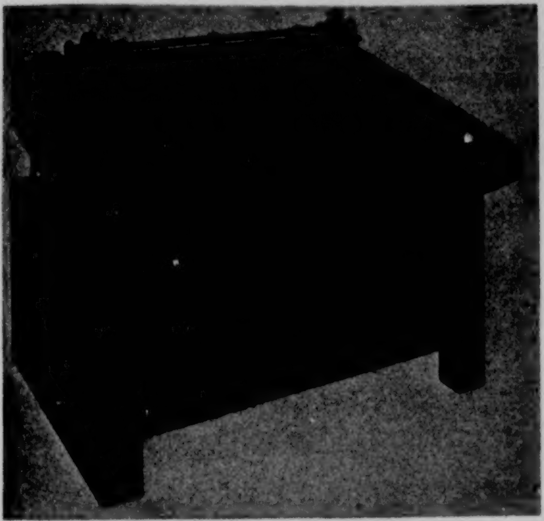
Figure 9-1.—A preprinted goldenrod masking sheet.

see the procedures for ruling-in guide lines on the goldenrod.

Some shops print layout guide lines on goldenrod to meet their particular stripping requirements. These layout sheets are more economical than preprinted sheets and they can be "customized" for certain jobs that are run often. Some examples of such jobs in a Navy shop are "Welcome Aboard" brochures and Change of Command programs.

Light Table

Do layout, stripping, and negative correction operations on a glass-topped table, which is illuminated from below. Some of these tables are equipped with built in movable horizontal and vertical straightedges as shown in figure 9-2.



57.732X

Figure 9-2.–Line-up table equipped with movable straightedges and spacing controls. A table without these features is called a light table.

The straightedges are positioned by hand, as shown in fig. 9-3. This type of table, called a line-up table, also has a spacing device which you set to allow the straightedges to travel a specific distance each time they are moved. Do this when drawing up forms or inscribing negatives.

Avoid placing heavy objects, such as boxes of paper, on the glass-top surface of a light table. Clean up immediately any liquids spilled on the glass to prevent them from seeping into the electrical wiring or along the edges of straightedges. Clean the glass surface of the table with a commercial glass cleaner and a soft rag every day.

Tape

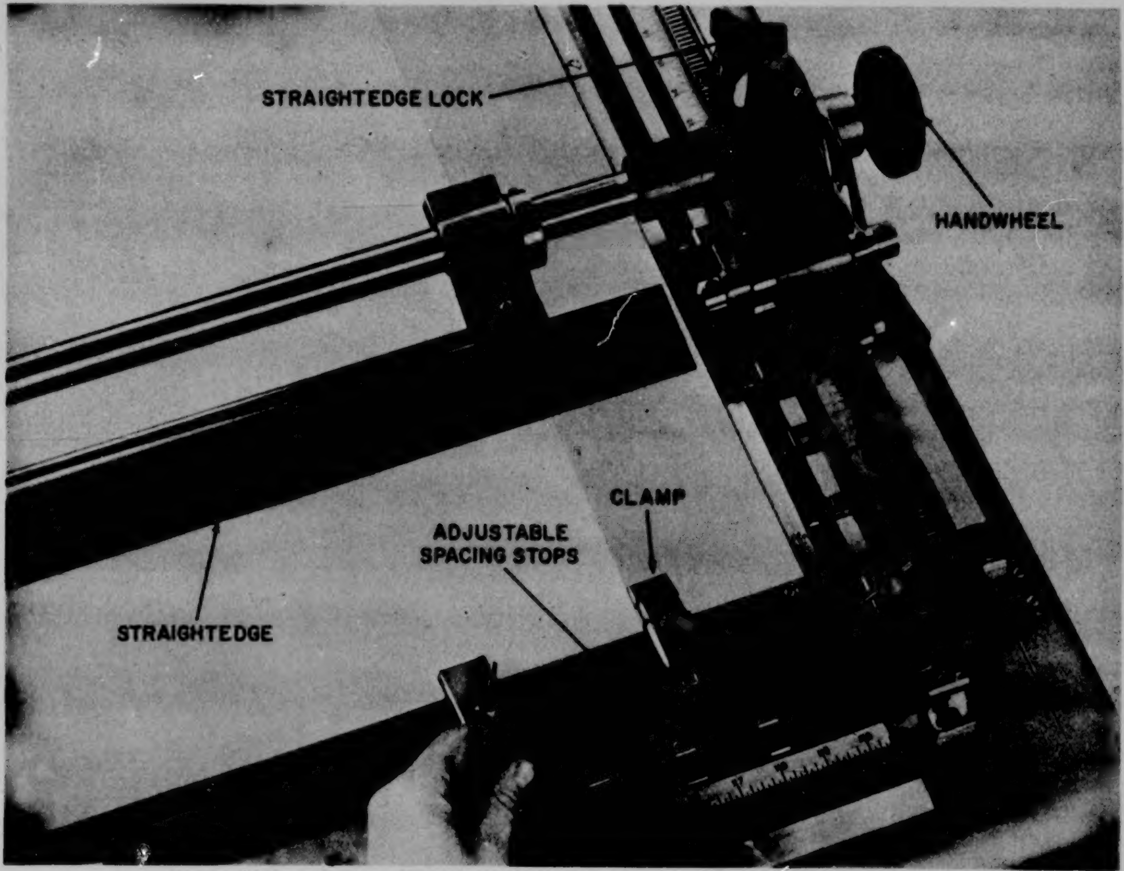
Negatives are attached to the goldenrod with either clear cellulose tape or with red or black tape, which is called lithographer's tape. Lithographer's tape is translucent and permits visual inspection when blocked out areas of a negative are examined over a light table. However, because of its color it won't allow light to pass onto the light sensitive coating of the plate.

When you use tape to attach negatives to the goldenrod, make sure that two pieces of tape do not overlap each other. Otherwise, the double thickness of tape will cause poor contact between the negative and the plate. This condition will cause the image on the plate to spread.

Use enough tape to prevent the negatives from slipping out of position or catching on something and tearing away from the goldenrod. A small strip at each corner and one along each side will usually be sufficient, but large negatives may require more.

Cutting Tools

Razor blades, cutting knives with replaceable blades and scissors are all used to cut film and goldenrod. When you cut film with a razor blade or knife, the film should be cut part way through and then bent so that the film separates along the cut line. When the film must be cut all the way through, place a piece of scrap film or glass under it to prevent the cutting tool from marring the light table glass.



57.733X

Figure 9-3.—Close-up view of the movable straightedges and spacing controls of a line-up table.

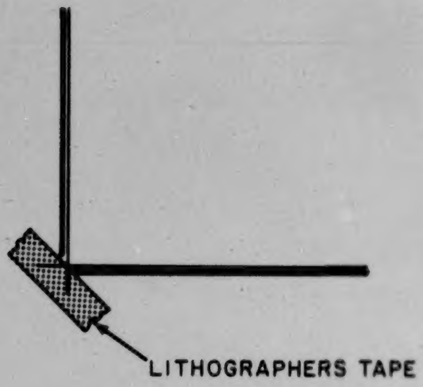
> CAUTION
>
> Sharp cutting tools are required for good workmanship, but they can also be dangerous. Never carry cutting tools in your pockets, or leave them on the light table where they can be covered and accidentally touched. Discard used blades in special containers, not in waste receptacles.

Using Cutting Tools

After the negatives are positioned and taped to the goldenrod, you must cut out areas of the goldenrod to expose the image areas of the negative. These openings are referred to as "windows." The goldenrod masking sheet with the windows is called a "flat."

Window openings in the goldenrod are made either with a razor blade or cutting knife. The cut must be made through the goldenrod only, not into the negative below the sheet. Type matter (line) windows may be cut out freehand, leaving about 1/8" of space around the image area of the negative. You must remove enough of the goldenrod to ensure that all of the image is uncovered. Remember, if you cut away too much goldenrod any uncovered defects in the negative will need to be corrected before the flat is ready to be sent to the platemaking section.

When you are cutting windows for halftone negatives, use a straightedge to obtain a window the exact size of the halftone image. After ruling-in an outline of the window on the goldenrod with a pen, place a straightedge along each side of the outline to make the cuts straight and square. The cuts must not run over each other at the corners or a mark may appear at the corner of the halftone image. If your cuts do overlap at the corner apply tape over the cuts as shown in figure 9-4.



57.734

Figure 9-4.—An over-cut in the corner of a halftone window on a masking sheet is corrected by placing a strip of lithographer's tape over the cuts.

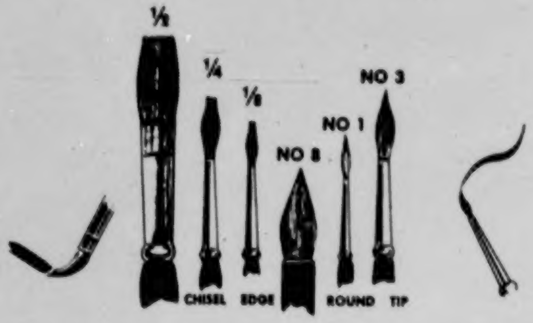
Corrections

Opaque is a light-proof paint which is used to spot out pinholes, shadow lines, and other undesirable markings on negatives. It can also be used to crop halftone negatives and to mask off parts of negatives which are used in color separation work. The dots in a halftone can also be altered with opaque to change their tone values.

Two types of opaque are in general use. Water soluble black opaque, with a pigment of carbon black, is generally used for fine detail work. Water soluble red opaque is somewhat thicker and more suitable for covering large areas. Red opaque is often used to label or to put other identification markings on negatives.

Opaque is applied to negatives with brushes which are shown in figure 9-5. The type of brush used depends upon the kind of opaquing necessary. A No. 1 round-tipped brush is ideal for fine detail work. Smaller brushes, such as 0 or 00 may also be used, but you will seldom need them. On the other hand, you will probably have frequent use for larger brushes, such as No. 3 or No. 5. A No. 8 brush can be used to cover large areas easily. The large, flat chisel edged brushes, shown in figure 9-5, are primarily lettering brushes. You can use them to apply opaque in long flat strokes on the negative.

Opaque may be applied to either side of the negative. However, since you will be working primarily with presensitized plates, opaque is generally put on the "right reading" or non-emulsion side of the negatives. This is because the surface of presensitized plates is very smooth and a build-up of opaque on the side of the negative which contacts the plate can cause poor contact between the negative and the plate. If opaque must be removed from a negative, it is less likely to be damaged if the opaque has been applied to the harder, non-emulsion side of the negative.



57.147

Figure 9-5.—Various types of brushes used to apply opaque on negatives.

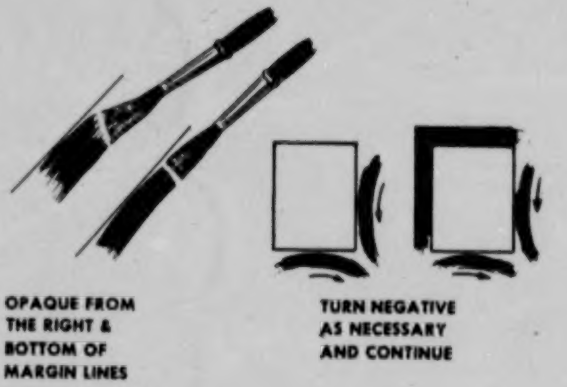
Although you may have occasion to opaque individual negatives, as a rule, the opaque is applied to the negatives after they have been taped to the goldenrod and the windows have been cut out of the flat.

Mix the opaque with water in a small container until it reaches the proper consistency to flow freely on the negative yet dry almost immediately. Many lithographers use the opaque jar's metal cap as the mixing container. To test the correctness of the opaque texture, they make several short strokes with the opaque brush on a scrap piece of film. When the opaque is beginning to dry by the time a one inch stroke is completed, it is mixed correctly.

You can spot out pinholes and other small areas with the tip of the brush. Larger areas, such as shadow lines should be covered with long, flat parallel strokes of the brush. Do not apply the opaque in heavy coatings. If it is necessary to recover an area, you may turn the negative over and touch up the other side. You can reduce the amount of opaquing required by covering large parts of the negative with pieces of goldenrod paper or litho tape. As you have already seen, the paper or tape masks out the light when the plate is exposed and serves the same purpose as the opaque. When goldenrod paper is used as a mask, it should be taped securely on the right reading side of the negative. Always keep the mask at least a quarter of an inch from the image areas. You can touch up the remaining areas of the negative with opaque, as necessary.

Cropping Halftones

You can crop halftones by ruling a straight outline on the negative with a ruling pen filled with opaque and then painting out the remaining background. The border lines should be at least 1/32" wide, because it is easier to opaque up to a line if it is reasonably thick. Work up to the outline by flattening the brush against the negative and drawing it along, as shown in figure 9-6. Work from the right and bottom side of your margin lines; then turn the negative, as shown in the illustration. You may also crop halftones by masking with goldenrod paper or with strips of red or black tape applied to the back of the negative. Be careful not to add too many thicknesses of tape or to allow the corners to overlap.



57.148

Figure 9-6.—Methods of applying opaque to an outlined area.

If you make an error in applying the opaque, correct it immediately so that you will not forget it. Use a clean, damp cotton swab and wipe outward from the center of the affected area. Keep turning the swab as you work so that you will not drag opaque back into a cleaned area.

NEGATIVE ENGRAVING

Shadows resulting from ridges on the copy, like those along the edges of paste-ups, show up as transparent lines on the negative and must be masked out or covered with opaque. Glare or reflections picked up in photographing the copy appear as dark areas on the negative. They may fill in portions of the image to such an extent that the negative cannot be used. But if they affect only a small area of the negative, you may be able to scratch them off the film with an engraving instrument.

You may also have occasion to engrave lines on negatives to clean up defective rulings, prepare rule forms, or to add boxes and borders. Negative engraving is also used in map work where grids (cross-lines) are generally placed on a master negative and then overprinted on all maps and charts of the same scale.

Figure 9-7 shows some of the tools used for engraving or scribing negatives. An engraving tool must remove the emulsion cleanly (cutting the emulsion in a continuous shaving) with each stroke; therefore it must have a sharp, square-cornered cutting edge.

You should tape the negative to a hard, smooth working surface, such as the top of a light table; a soft surface, such as another negative or paper, will cause the engraving tool to crease, cut through the film, or make irregular lines.

Engraving tools are available in various sizes and shapes. There are tools for lettering as well as for single and double lines. Some of these tools are constructed to provide uniform pressure, width, and angle, but in most cases, the handling of the tools depends on the skill of the operator. The cutting quality depends on the sharpness and shape of the point, the angle at which the tool is held, and the amount of pressure applied. A dull point or a needle point will furrow the emulsion and produce a ragged line.

The needle point may be used, of course, to engrave a clean line through a soft emulsion with a hard base, such as glass. You may also use it for making marks when you are measuring or for picking up or sliding smaller pieces of film into position.

Ruling Lines

To scribe lines on a negative, you should square the film and tape it, emulsion side up, to the light table. If the negative requires opaquing, you should apply the opaque (on the emulsion side) before starting to rule it.

If your shop has a precision line-up table, you can find the locations for the lines by moving the metal straightedge along the scale on the side of the table or by using the automatic spacing device at the end of the straightedge. This device can be set to cause the straightedge to travel a specific distance each time it is moved and is ideal for ruling a series of lines. If you do not have a line-up table, mark the location of each line to be drawn with a pair of dividers or engraving point and a steel rule. If a copy of a previously printed form is available, use it in locating the positions for your lines. Square the printed form and tape it beside the negative. Then position the straightedge on the printed lines and scribe corresponding lines on the film.

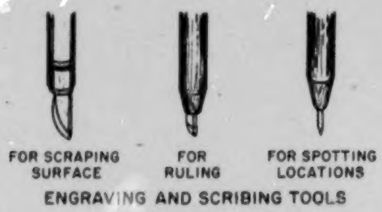
After you have marked the location of each line, draw a light pencil line on each side, along the margins, to show the length of the lines. You are then ready to start your ruling. It is a good idea to test the engraving tool in the margins of the negative before you begin ruling. Test marks can be touched out afterwards with opaque. If your lines are uneven in length, you can even them by opaquing or by applying strips of red tape to the back of the negative along the ends of the rules.

STRIPPING A FLAT

Since you will be working almost entirely with negatives and goldenrod paper, you will have to master the goldenrod stripping process. The following pages outline the procedures to strip negatives on plain, unprinted goldenrod paper serving as the layout masking sheet. If your shop uses preprinted goldenrod, the procedures are basically the same, however you won't need to rule-in guide lines on the goldenrod. Once you have acquired a complete understanding of stripping on plain goldenrod, you will find that the use of preprinted goldenrod masking sheets simplifies the work.

Planning the Layout

Before you begin stripping, carefully read the instructions that accompany the job. If the job consists of multiple pages, there probably will be a master layout or dummy that you can use as masking sheet layout guide. But for many jobs, the masking sheet layout planning will be left



57.602
Figure 9-7.—Negative engraving and scribing tools.

entirely to you. In either case, you must accurately rule-in guide lines on the goldenrod so that the negatives will be properly aligned and positioned on the layout.

Check each negative for correct size and quality and then arrange them in proper sequence. The negatives should also be trimmed with a hand paper cutter or scissors, leaving at least one-half inch around the image areas. If any of the negatives are to be spliced or butted together, or any of the pages are to bleed, you will have to adjust the trimming accordingly. (A page is said to bleed when it runs off the edge of the paper.) Negatives that are to bleed are best trimmed after they have been positioned on the goldenrod, so that you can actually see how much of a trim is required.

One of your primary considerations when you are planning a layout is the size of the press to be used to run the job. If your shop has only one size of press, this will present no problem, but if you have two or more sizes, check with your shop LPO if the press size is not indicated on the job jacket. If the job requires a long press run, it may be better to set up the plate to run the job more than one-up on a large press. As you will see later, you can do this by making several negatives and stripping them on the same flat or by making one negative and exposing it in different locations on the plate.

Of course, if the run is short, the extra work involved may not make it worthwhile to print more than one-up so it may be better to run the job singly on a smaller press. If close register is involved it may also affect the choice of press, because the larger presses often register better than the smaller ones. Large solids and halftones may also run better on the larger presses.

As a rule, it is best to place large solids and halftones along the gripper and center of the layout if no other considerations are involved. Close register work should also be placed along the gripper and in the center of the sheet. You will learn more about the gripper edge in just a minute.

Ruling the layout

Once these things have been settled, you are ready to start ruling the layout. Select a sheet of goldenrod paper the size of the press plate, and square it to the layout table by aligning one of the long sides with the T-square. If the paper is ragged or cut crooked, trim it with a knife or razor blade using a steel straightedge as a guide. Tape or clamp the paper to the layout table being careful not to move or bulge the sheet.

You should use a thin, short line to indicate measurements on the layout sheet. Some operators make precise marks by punching the sheet with a needle point and later covering the holes with lithographer's tape to prevent them from printing on the plate. Make your measurements with a steel rule, because the steel rule is more accurate than wood or plastic rules. If the rule does not have space to the left of zero, some operators use the 1" mark as the starting point, because it is difficult to locate the zero point accurately. Most operators rule the sheet with a black or blue ball-point pen. It is difficult to see the lines when a hard pencil is used, and soft pencil lines tend to spread. When marking dimensions with points, it is helpful to circle the points so that you can see them readily.

Gripper Margins

On every goldenrod layout sheet you must allot space for the plate and paper gripper margins. These margins vary from one type of press to another, so you will have to know the specific margins for each press in your shop. There cannot be any image area within the gripper margins.

The plate gripper margin is the narrow strip, along the leading and trailing edges of the plate, where the clamps or grippers on the plate cylinder grasp the plate when it is on the press. Because work is generaly positioned along the leading edge of the plate, it is not necessary to indicate the trailing edge gripper margin on the layout unless the image area is exceptionally large.

The paper gripper margin is the amount of space required along the leading edge of the paper for the "bite" of the impression cylinder grippers as they draw the sheet through the printing unit of the press.

When you have determined the gripper margins for your layout, draw lines along the layout sheet edge which you have designated the gripper edge. Some strippers rule two solid lines to indicate each margin, while others use a dotted line to indicate the paper margin. The second line may be omitted altogether if the two distances are combined.

Other Reference Lines

In addition to the gripper margin lines, you should measure the goldenrod sheet and draw a centerline to be used as a reference point for centering images on the layout.

Most strippers also draw in lines to show the outline of the press sheet on the layout. If the job is to be trimmed after it is run, you may want to draw in additional lines to indicate the trim size of the sheet.

The amount of ruling you do on the layout sheet depends on the nature of the job and your own preferences. Some men like simple layouts, while others prefer to make involved layouts of the simplest flats. Until you have gained experience, you should use as many reference lines on your layouts as possible to ensure that they are accurate.

You will learn about other reference lines and register marks later in this chapter.

Making a Simple Layout

An actual example will help you to better understand the steps involved to produce a simple flat. The steps are illustrated in figure 9-8.

For the purposes of this flat, assume that you have been given a job that calls for 3000 copies of a standard Navy letterhead. (The copy has been set in your shop and the cameraman has furnished you with the negative.) The instructions which accompany the job state that the type matter is to be centered, side to side, on a 8" X 10½" sheet. The head margin, which is the space between the top line and the top edge of the sheet, is 5/8".

The LPO of your shop has informed you that the job will be run on the 1250 Multilith press, using a serrated (looped) plate. The plate gripper margin is 1" and the paper gripper margin is ¼". (Note: These margins are not actual gripper margins, but are used here for illustrative purposes.)

After inspecting the negative, you select a sheet of goldenrod the size of the press plate and proceed as detailed in figure 9-8, through step 6.

Position the Negative

After you have completed the steps shown in figure 9-8, you are ready to position and attach the negatives to the goldenrod sheet.

For this flat the negative must be centered from right to left. This will place the center of the negative on the centerline you have drawn on the layout. To find the center of the negative, measure the longest line of type and make a mark on the emulsion side of the film, as shown in figure 9-9. On the 5/8" line of the layout align the mark on the negative with the centerline on the layout. When the position is correct, tack the negative with two pieces of tape to the underside of the goldenrod.

After the negative is tacked in position, turn the flat over and fasten down the negative securely with additional tape. Do not put the tape closer than ¼" to the image areas.

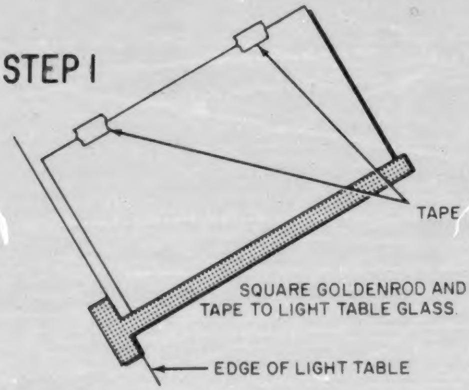
Next return the flat to its original side and cut out the opening (window) for the image area of the negative. As you gain experience, you will acquire the feel that will allow you to use just enough pressure to cut through the goldenrod without cutting into the film. The size of the window should not be larger than necessary to uncover the image areas of the negative. Otherwise, it may be necessary to opaque pinholes or other defects in the negative which would have remained covered by the goldenrod.

Sometimes after numerous windows have been cut in a flat, the flat will lose its rigidity. In such a case, if the negatives are not halftones, you can place strips of transparent tape on the front side of the flat in areas where it is weak. Clear tape placed over the image areas of a line negative will not ordinarily interfere with the plate exposure providing the tape is not dirty.

Stripping for Narrow Widths

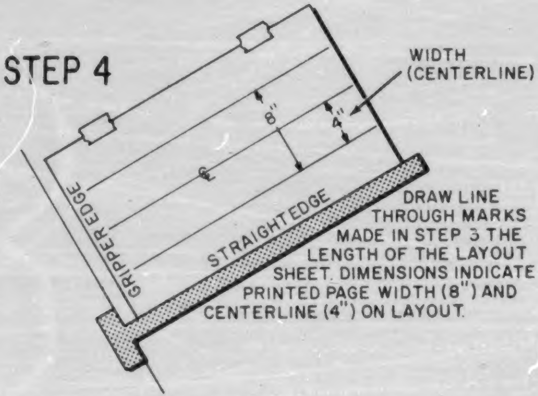
As the sheets travel down the feedboard to the printing unit of an offset press, they pass

STEP 1


TAPE
EDGE OF LIGHT TABLE

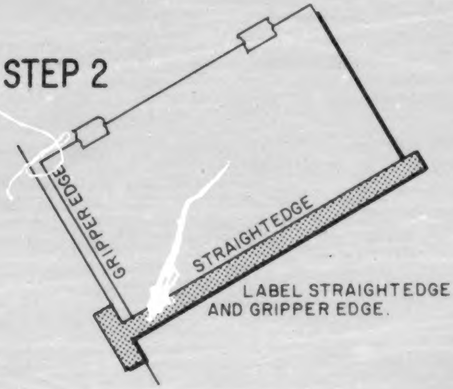
SQUARE GOLDENROD AND TAPE TO LIGHT TABLE GLASS.

STEP 4


WIDTH (CENTERLINE)
8"
4"
℄
GRIPPER EDGE
STRAIGHTEDGE

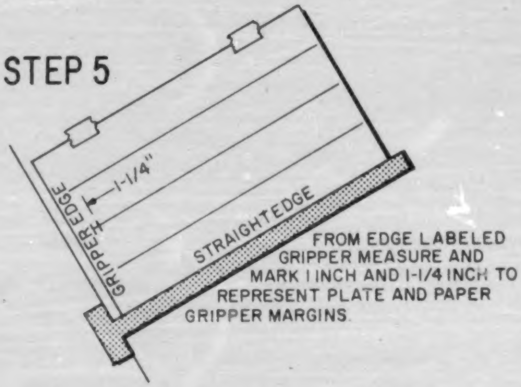
DRAW LINE THROUGH MARKS MADE IN STEP 3 THE LENGTH OF THE LAYOUT SHEET. DIMENSIONS INDICATE PRINTED PAGE WIDTH (8") AND CENTERLINE (4") ON LAYOUT.

STEP 2


GRIPPER EDGE
STRAIGHTEDGE

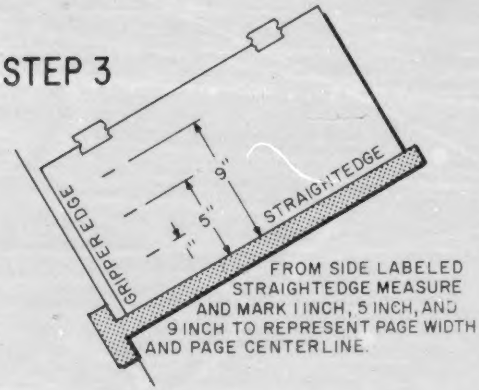
LABEL STRAIGHTEDGE AND GRIPPER EDGE.

STEP 5


GRIPPER EDGE
1-1/4"
STRAIGHTEDGE

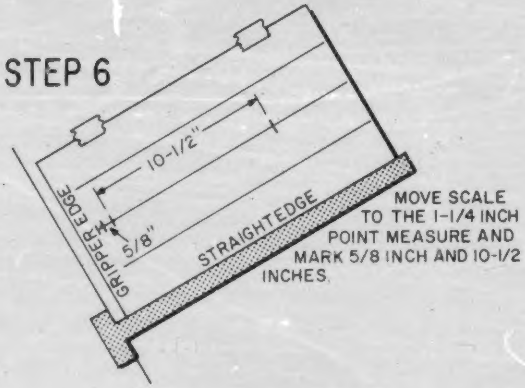
FROM EDGE LABELED GRIPPER MEASURE AND MARK 1 INCH AND 1-1/4 INCH TO REPRESENT PLATE AND PAPER GRIPPER MARGINS.

STEP 3


GRIPPER EDGE
9"
5"
1"
STRAIGHTEDGE

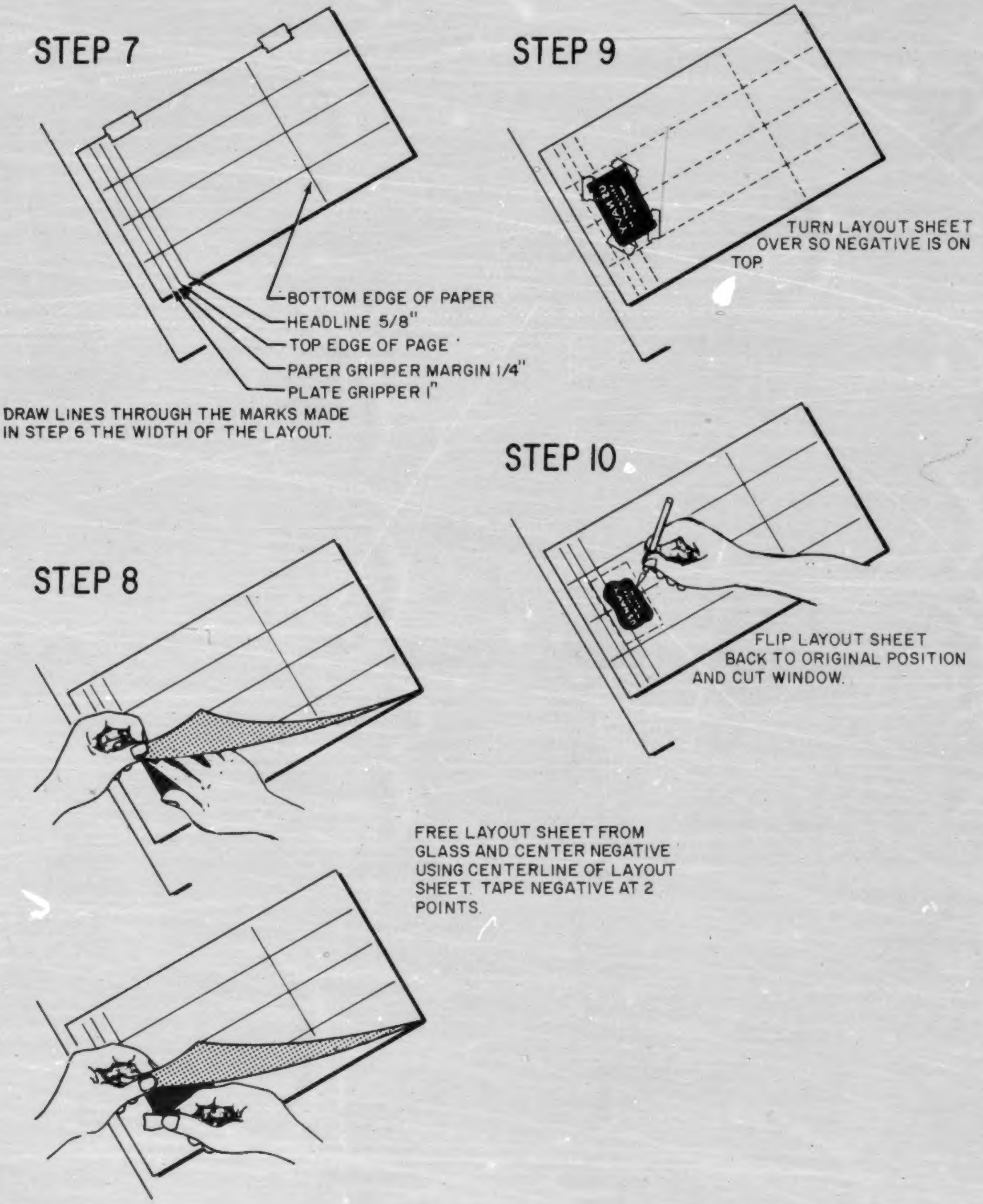
FROM SIDE LABELED STRAIGHTEDGE MEASURE AND MARK 1 INCH, 5 INCH, AND 9 INCH TO REPRESENT PAGE WIDTH AND PAGE CENTERLINE.

STEP 6


GRIPPER EDGE
10-1/2"
5/8"
STRAIGHTEDGE

MOVE SCALE TO THE 1-1/4 INCH POINT MEASURE AND MARK 5/8 INCH AND 10-1/2 INCHES.

57.735

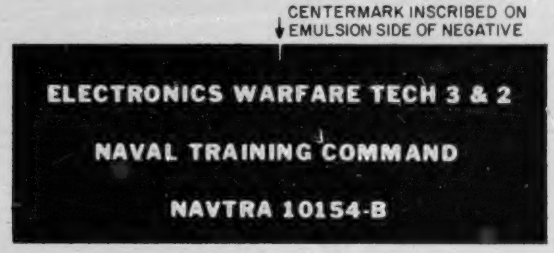

STEP 7
BOTTOM EDGE OF PAPER
HEADLINE 5/8"
TOP EDGE OF PAGE
PAPER GRIPPER MARGIN 1/4"
PLATE GRIPPER 1"
DRAW LINES THROUGH THE MARKS MADE IN STEP 6 THE WIDTH OF THE LAYOUT.
STEP 9
TURN LAYOUT SHEET OVER SO NEGATIVE IS ON TOP.
STEP 10
FLIP LAYOUT SHEET BACK TO ORIGINAL POSITION AND CUT WINDOW.
STEP 8
FREE LAYOUT SHEET FROM GLASS AND CENTER NEGATIVE USING CENTERLINE OF LAYOUT SHEET. TAPE NEGATIVE AT 2 POINTS.

57.735

Figure 9-8.—Layout and stripping procedures for a simple flat.

under a device known as the "sheet detector" or "impression trip." If a sheet fails to pass along the feedboard, this device prevents the blanket from contacting the impression cylinder. Otherwise, without the paper to receive the image from the blanket, the image would print on the impression cylinder, and the next sheets fed through the press would be printed on both sides.

The sheet detector is generally located in the center of the feedboard so that it will contact most sheet widths. But on some presses, such as Multiliths, the detector is located off center toward the far (non-operator) side of the feedboard. Therefore, narrow-width jobs must be positioned off center on the flat as shown in figure 9-10. This ensures that narrow-width sheets will contact the detector on these presses. The location of the detector or impression trip can be seen on the preprinted masking sheet shown in figure 9-1.


CENTERMARK INSCRIBED ON EMULSION SIDE OF NEGATIVE
ELECTRONICS WARFARE TECH 3 & 2
NAVAL TRAINING COMMAND
NAVTRA 10154-B

57.736

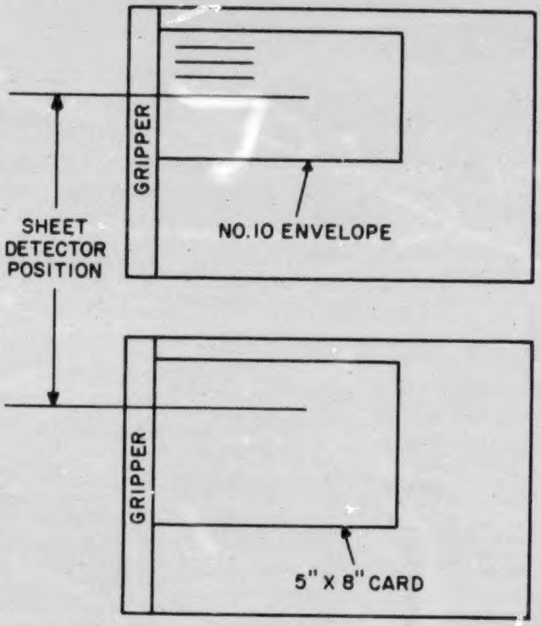
Figure 9-9.—To indicate the center point of a negative, measure the line to be centered on the layout and place the center mark outside the image area.

Preparing Flats for Larger Presses

When a flat is prepared for a larger press, the procedures are essentially the same as those used to make the smaller, one-page flat.

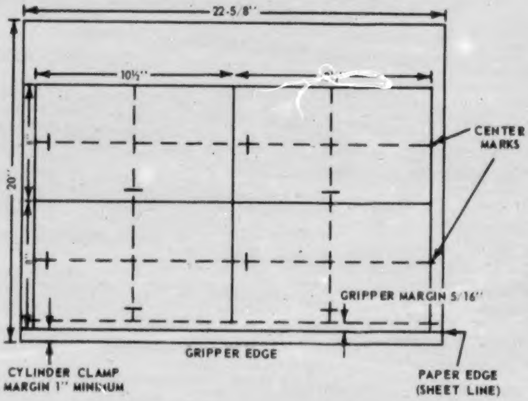
After drawing the basic guide lines, which represent the press sheet outline and the plate and paper gripper margins, the layout sheet is divided into fourths, eighths, or whichever page multiple is required. Next, the guide lines for each page are drawn to indicate the side and head margins for the individual pages. (See fig. 9-11.)

Once the ruling is completed, the negatives are placed, one at a time, underneath the flat and attached to the goldenrod with tape. When


GRIPPER
SHEET DETECTOR POSITION
NO. 10 ENVELOPE
GRIPPER
5" X 8" CARD

57.607X

Figure 9-10.—Off center layout position for narrow width sheets that are to run on Multilith presses.


22-5/8"
10½"
20"
CENTER MARKS
GRIPPER MARGIN 5/16"
GRIPPER EDGE
CYLINDER CLAMP MARGIN 1" MINIMUM
PAPER EDGE (SHEET LINE)

57.153

Figure 9-11.—Goldenrod layout for a four-page job to be run on a large press.

the negatives have been securely taped to the back of the flat, windows are cut in the goldenrod to expose the image areas of the individual negatives.

OTHER STRIPPING METHODS

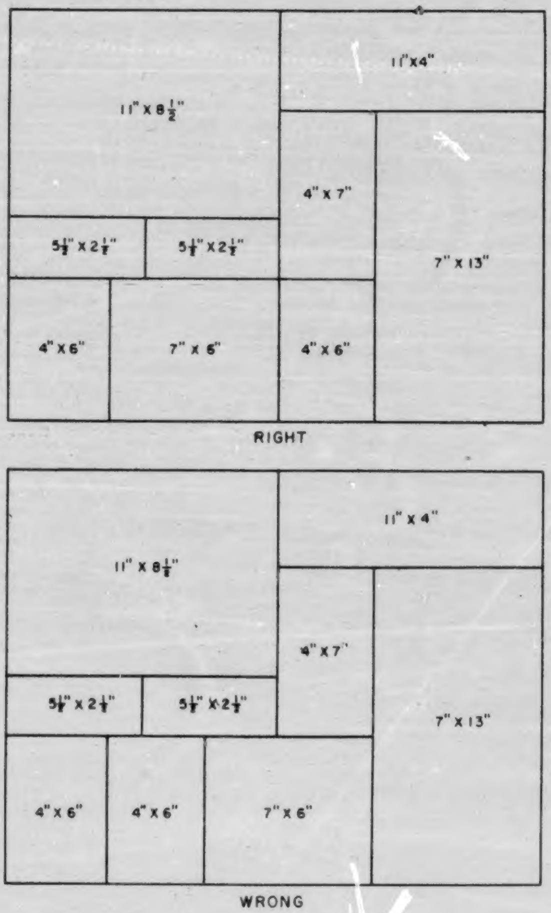
Of course, all strippers do not work alike. Instead of tacking the negatives to the goldenrod sheet in the manner just discussed, some strippers position the negative under the goldenrod and then cut two small holes in the layout sheet–one in the upper left corner and one in the lower right corner–and then place a strip of red tape over each hole to tack the negative to the sheet. After the negatives have been tacked in place, the stripper turns the flat over and tapes them securely or he may cut windows in the goldenrod sheet to expose the image areas of the negatives and then do his taping along the edges of the windows. Some operators use this procedure when working with presensitized plates, because this eliminates the necessity for having any tape on the emulsion side of the negatives and provides better contact between the plate and film when the plate is exposed.

GANG LAYOUTS

Many times to ssve paper or press time, you will find it advisable to run a number of unrelated jobs on the same sheet of paper and to separate them later by cutting. This type of layout is known as a "gang" layout. You can use it if all jobs work out to the same or approximately the same press run; all jobs call for the same kind of paper and ink; and all jobs cut out of the press sheet properly.

It goes without saying that you cannot combine into one layout two or more jobs which require a different number of copies, unless you can run one of the jobs two or more up so that all jobs can be completed with the same number of impressions. For example, if one job requires 2,000 impressions and another requires 4,000, you can plan the work and strip it up for one press run if you use one negative for the first job and two negatives for the second. Two thousand impressions will then be required to produce the desired 2,000 copies of the first job and 4,000 copies of the second.

If the jobs are of different sizes, are arranged in staggered locations, or have differing head directions, you should make a rough sketch showing the shape, trim size, location, and head direction of each job that is to be included in the layout. You should check your sketch to make sure that the jobs can be cut apart after they are printed. As you can see in figure 9-12, if you do not position the jobs properly, it will be impossible to separate them without cutting



57.609

Figure 9-12.–Gang or combination layout. Individual jobs must be arranged so that they can be separated when they are cut apart.

through and spoiling one or more of them. You can also use your rough sketch to save bindery time by planning the work so that the forms can be separated with a minimum number of cuts. In some cases, it may be necessary to make several sketches to determine which layout will require the least number of cuts after the job is printed. (Some operators cut pieces of paper to the size of the various jobs and move these around on the layout sheet until they find the best arrangement. This is somewhat easier and less time-consuming than drawing a series of sketches.)

The procedure for preparing a gang flat is similar to the layout procedures already discussed. You should draw in the sheet line and the gripper margin first. Next locate the position for each job and draw its outline in the proper position on the goldenrod. If the middle job is exactly centered, or if its edge coincides with the vertical center of the flat, you can draw its location first. Otherwise, it is easier to begin at one of the outside corners along the gripper edge.

When you are ganging up work, it is likely that some of the jobs will require additional trimming after they have been cut from the press sheet. If illustrations are to bleed, for example, you must make allowance not only for the cut but also for additional trimming, so that the bleed will not run into the margins of the adjoining job. (See fig. 9-22.) A double trim allowance must also be included if any of the negatives are to bleed along the gripper margin. In this case it is better to allow extra margin for all the forms along the gripper edge so that it will be possible to make a single cut along this side after the job is printed. You will learn more about bleed illustrations later in this chapter.

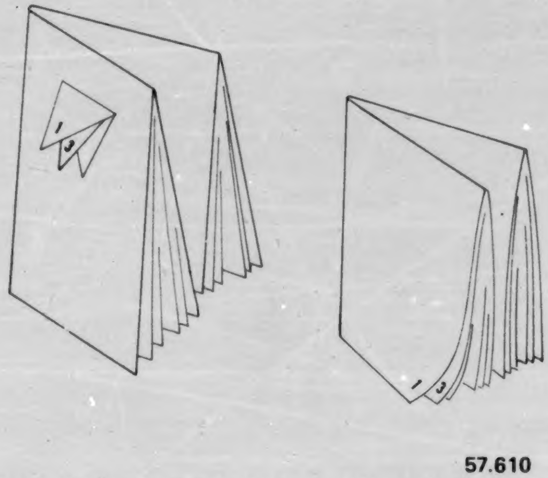
Bookwork Imposition

The layout location of negatives or positives on the flat is termed "imposition." Impositions for bookwork are similar to those required for other types of work, with two important exceptions: (1) the pages must be arranged in a specific order so that they can be backed-up properly and will fold down in sequence, and (2) the margins must be calculated to include a double trim on all inside edges except the binding edges of the pages.

Imposition Charts

When you are stripping negatives for bookwork, it is necessary to prepare an imposition chart to ensure that the pages are laid out in the proper order. An imposition chart is simply a blank press sheet folded down to page size with page numbers (folios) in the proper order. (See fig. 9-13.) Many shops keep a supply of machine folded blank sheets on hand to use in preparing imposition charts.

After you have marked the folios on the imposition sheet, it is unfolded and used as a guide in laying out the goldenrod sheet. When the negatives are stripped underneath the goldenrod layout, the folio positions should correspond exactly with the folios of the imposition chart. However, because of the large size of bookwork flats and the difficulty encountered when they are flipped over to tack the negatives in place, many strippers work from the top rather than underneath the flat. In this case, it must be remembered that the flat will be turned over when the plate is exposed so that the emulsion side of the negatives will be in contact with the plate. When the flat is turned over, the positions of the negatives are reversed. The negatives on the left side of the flat will appear on the right side of the flat and vice versa. Therefore, the folios on the goldenrod must be marked in reverse from the order in



57.610

Figure 9-13.—Two methods of preparing an imposition chart. After indicating the page folios, the signature is unfolded and used as the layout guide.

which they appear on the imposition chart. Figure 9-14 illustrates this point clearly.

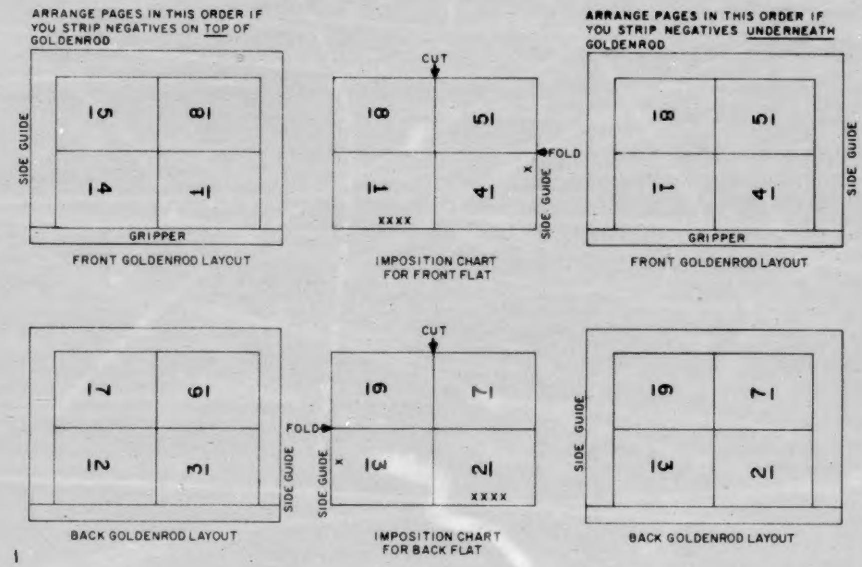
Sheetwise Impositions

There are several types of impositions, and you may use the one that serves your purpose best, considering the capabilities of your equipment. Many jobs call for sheetwise (back-up or face-and-back) layouts in which the pages for one flat and back-up pages are prepared on another. These flats are sent to the platemaker who uses them to make two separate plates. The pressman then puts the plate made from the first flat on the press and runs the paper through. Then he removes this plate and puts on the one carrying the back-up pages, turns the stock over left to right, and runs it through the press again to back up the sheets. If the job is large and consists of several signatures, he usually runs all the fronts first, then backs them up in order. In very large shops, one press may be used to run the fronts and another press may be used for backing the sheets up.

Figure 9-14 shows the imposition for a two-plate job. When a job consists of more than one flat, you should number each layout for proper identification. The first front flat should be marked "F-1"; the next front flat, "F-2", and so on. The first back flat should be marked "B-1", "B-2", and so on.

You have just seen that the stock is turned over from left to right when it is run through the press for back-up. This means that the gripper edge of the stock is fed to the front or head guides on both runs through the press. However, it is necessary for the pressman to use the side guide on the opposite side of the feedboard when he makes his back-up run so that the same edge of the stock will be fed to the side guide during the second run. For this reason, most strippers identify both the gripper and side guide edges of each flat, using "x" marks in the same manner as they mark the imposition charts.

Study the sheetwise impositions shown in figure 9-14 for a moment. Notice that the heads of the pages are toward the vertical centerline and the bind falls along the horizontal center-


ARRANGE PAGES IN THIS ORDER IF YOU STRIP NEGATIVES ON TOP OF GOLDENROD
SIDE GUIDE
5
8
4
1
GRIPPER
FRONT GOLDENROD LAYOUT
CUT
8
5
1
4
FOLD
x
SIDE GUIDE
xxxx
IMPOSITION CHART FOR FRONT FLAT
ARRANGE PAGES IN THIS ORDER IF YOU STRIP NEGATIVES UNDERNEATH GOLDENROD
8
5
1
4
SIDE GUIDE
GRIPPER
FRONT GOLDENROD LAYOUT
7
6
2
3
BACK GOLDENROD LAYOUT
CUT
FOLD
SIDE GUIDE
SIDE GUIDE
x
6
7
3
2
xxxx
IMPOSITION CHART FOR BACK FLAT
SIDE GUIDE
6
7
3
2
BACK GOLDENROD LAYOUT

57.612

Figure 9-14.—Sheetwise imposition for an 8-page booklet. If the negatives are stripped on top of the layout sheet, the flat is turned over when the plate is exposed. Therefore, the negatives must be reversed on the goldenrod layout as shown on the left. When the negatives are stripped under the layout sheet, their position is identical to the position of the pages on the imposition chart, as shown on the right.

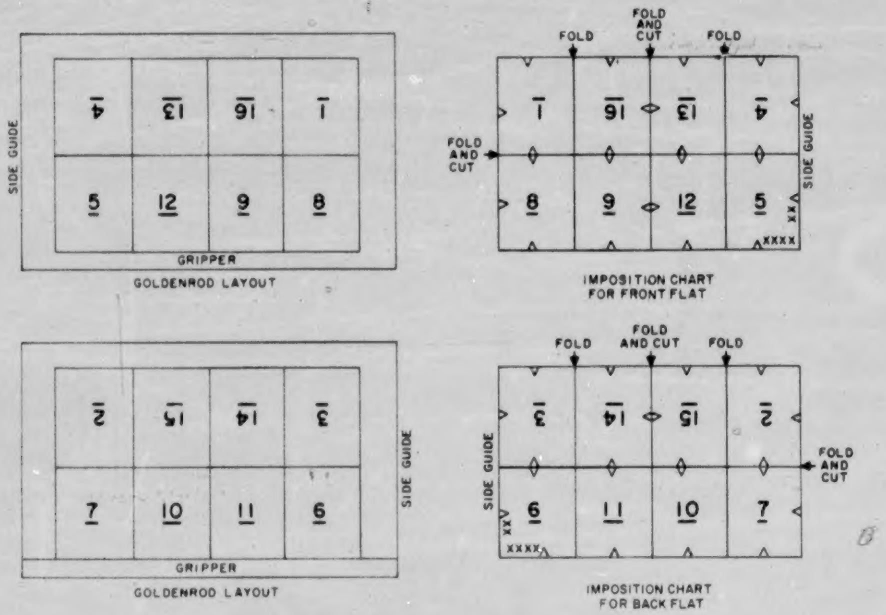
line. This means that the job will be folded on the horizontal centerline and will be trimmed along the vertical centerline after printing. Notice also that if you add the folios of the adjoining pages (across the fold), as 8 and 1, 4 and 5, 6 and 3, and so on, the total will always be 9. If you are working with a 16-page book, the total will be 17; and if you are working with a 32-page book, the total will be 33. This holds true in all cases except when you are laying out a very large book containing front matter, such as a preface and table of contents, which are usually marked with roman numerals (i, ii, iii, and so on) or when the front matter contains blank pages. In this case, you must add the front matter and blanks to your total.

Page 1 must always begin on a right hand page, even if you have to leave a page blank in order to accomplish it. This means that the odd pages will always fall to the right of the bind and the even numbered pages will always be on the left. For this reason, odd-numbered pages are often referred to as "right hand pages."

Now compare the 16-page sheetwise imposition shown in figure 9-15 with the 8-page imposition shown in figure 9-14. The pages have been rearranged so that the horizontal centerline now represents the head or cut line. Notice that all folios on opposite sides of the fold add up to 17. Also notice that the diamond shaped notches indicating double trim appear on both horizontal and vertical centerlines.

Work-and-Turn Impositions

Sometimes you can work and turn a sheet that is to be printed on both sides. This means that you can strip negatives for both front and back-up pages in the same flat. For example, the front or outside pages may appear on the left side of the flat and the back-up or inside pages may appear on the right or vice versa.


SIDE GUIDE
4
13
16
1
5
12
9
8
GRIPPER
GOLDENROD LAYOUT
FOLD
FOLD AND CUT
FOLD
1
16
13
4
FOLD AND CUT
8
9
12
5
SIDE GUIDE
XX
XXXX
IMPOSITION CHART FOR FRONT FLAT
2
15
14
3
SIDE GUIDE
7
10
11
6
GRIPPER
GOLDENROD LAYOUT
FOLD
FOLD AND CUT
FOLD
3
14
15
2
SIDE GUIDE
FOLD AND CUT
6
11
10
7
XX
XXXX
IMPOSITION CHART FOR BACK FLAT

57.154

Figure 9-15.—Sheetwise imposition for a 16-page booklet. Arrange the pages on the goldenrod layout in the order shown at the left if you are stripping the negatives on top of the layout. Arrange the pages in the order they appear on the imposition chart, if you strip the negatives under the layout sheet.

When the stock is run through the press, the front and back-up pages will be printed on the same side of the sheet. If the job calls for 5,000 copies, the pressman will run 2,500 sheets (plus a few extra sheets for waste) through the press. He will then turn the sheets over, left to right, and run them through the press again, using the same plate to print on the reverse side of the stock. In doing so, he maintains the same gripper edge on the stock as before, and even though the stock is turned over he maintains the same side guide edge by simply using the side guide on the far instead of the near side of the feedboard when he makes the second run. After the 2,500 sheets are printed on both sides, they are cut in half to separate the right and left halves of the sheets). Each half will be a complete, backed-up unit and he will have a total of 5,000 properly backed sheets. Figure 9-16 shows how work-and-turn jobs are imposed.

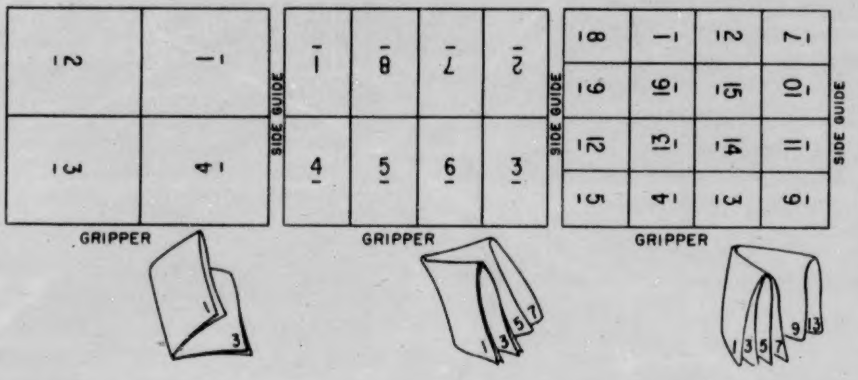
Work-and-Tumble Impositions

Work-and-tumble (sometimes called work-and-flop) impositions are similar to work-and-turn except that the negatives are arranged on the flat so that the sheet can be flopped over top to bottom instead of left to right when it is backed up. (See fig. 9-17.) Work-and-tumble layouts are not used often because they do not provide as good register as work-and-turn layouts.

When you are stripping for bookwork, it is always best to use the vertical and horizontal centerlines as your reference points for all measurements. This is particularly important when you are working with a work-and-tumble job, because you will not use the same gripper edge when you turn the sheets over and make your second run. When preparing work-and-tumble layouts, the stripper generally cuts in tick marks at the end of the horizontal centerline and these marks print on the plate and in the trim area of the paper stock. The pressman uses these marks for reference when he positions the back-up run on the press. You will learn more about these tick marks later.

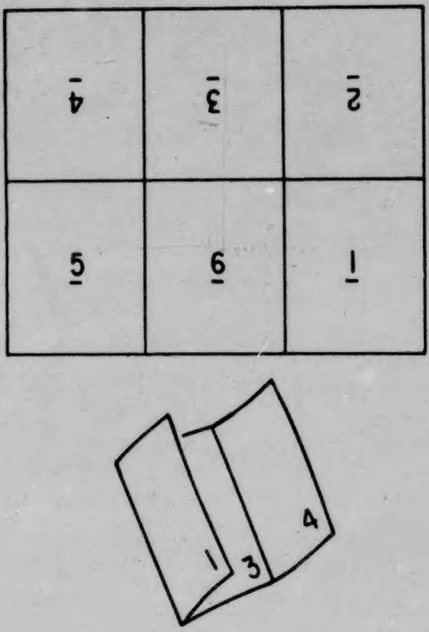
Preparing the Flat

Since all pages are the same size, it is possible to use a translucent master layout when you are preparing flats for bookwork. These master layouts were discussed earlier in this chapter. Otherwise, the layout procedure for bookwork is similar to that used in preparing other types of flats. You should draw in your basic reference lines first. You must remember however, that the pages must be trimmed on two or three sides. Notice in the layout shown in figure 9-18 that a trim margin has been indicated along the gripper edge of the press sheet. If the book is small, it is possible to omit this trim, but if the book is large, it is generally necessary to trim



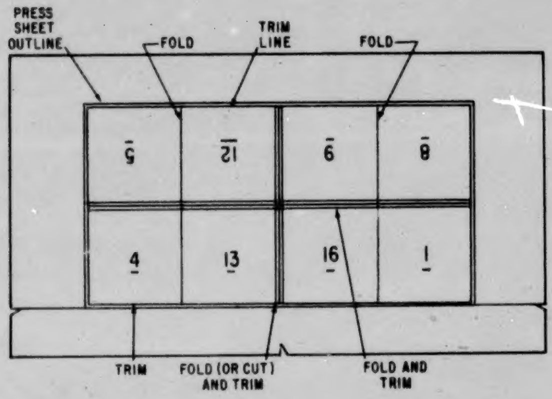
57.155

Figure 9-16.—Work-and-turn impositions. Compare the 16-page one plate imposition shown here on the right with the 16-page two plate imposition shown in figure 9-15.



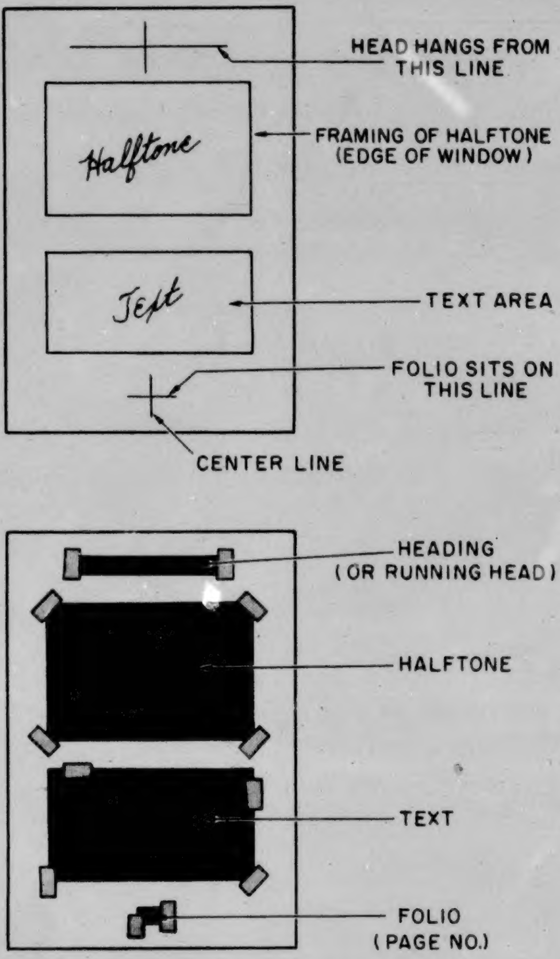
57.613
Figure 9-17.—Work-and-tumble imposition.

along this edge rather than to use the edge of the press sheet as the edge of the finished job. Work-and-turn and certain other types of work require that the signatures be cut before the pages are folded and stitched and again afterwards. This means that some of the sides will be cut twice. Figure 10-22 shows how to allow for this when you are laying out the work.


PRESS SHEET OUTLINE
FOLD
TRIM LINE
FOLD
5
12
9
8
4
13
16
1
TRIM
FOLD (OR CUT) AND TRIM
FOLD AND TRIM

57.614
Figure 9-18.—Layout imposition showing trim margins.

When a book contains a number of pages, several signatures may be inserted one inside the other for saddle stitching in the bindery. You will find that the inner pages "creep" or "push out" approximately 1/32" in each 16-page signature. This means that the outer margins will be progressively narrower on the inner pages. You can remedy this by allowing less margin along the gutter and more along the outside of the page about every third signature. If you are

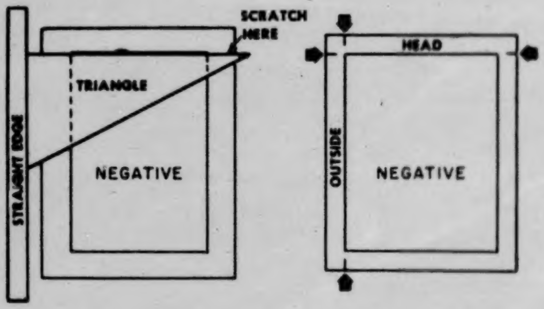

HEAD HANGS FROM THIS LINE
Halftone
FRAMING OF HALFTONE (EDGE OF WINDOW)
Text
TEXT AREA
FOLIO SITS ON THIS LINE
CENTER LINE
HEADING (OR RUNNING HEAD)
HALFTONE
TEXT
FOLIO (PAGE NO.)

57.162
Figure 9-19.—How guide lines are used to aid in positioning the running head, art, text, and folio on a page consisting of several separate negatives.

not sure about the degree of push out, you can determine it by using sheets of the stock to be run when you make your imposition chart and running a needle through the pages. Then measure from the needle mark to the edges of the pages.

Frequently, the pages of a book will consist of several small negatives and you must make up the pages by placing the negatives in their proper positions on the layout. The illustration at the bottom in figure 9-19 shows a page made up of four separate negatives. The illustration at the top shows how you can rule lines on the flat to aid in locating the various components. Cross-marks like those shown in the illustration are often used in locating the folios for the pages.

Since the pages of text are generally the same width in bookwork, most operators strip to the margins of the text rather than to center marks. Figure 9-20 shows how to scribe a negative by extending a ruler along the type margins and scratching marks in the emulsion along the edges of the negative. These marks can then be alined with corresponding lines ruled up on the layout sheet.



57.159X

Figure 9-20.—Method of marking text margins for bookwork on the negative.

Fold and Trim Marks

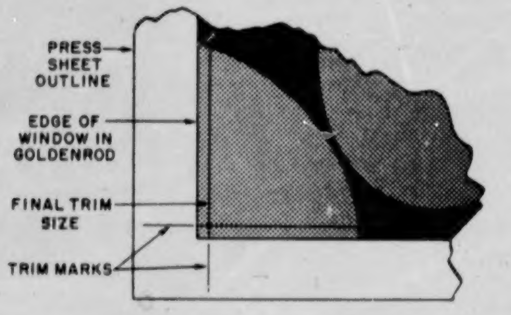
Small pieces of film with inscribed lines are placed on bookwork flats to indicate the fold line of the printed sheet. These marks, which are commonly referred to as "tick marks," are also used to indicate the trim margins. Tick marks should be placed on the flat so that they are located inside the press sheet area, but outside the finished page margins. When the mark is located at the junction of two fold lines in the center of the flat, it is called the "centerfold tick mark."

You can make tick marks from the pieces of film trimmed from negatives or from a full sheet of exposed and processed film. Cut the film into ½" strips and scribe a hairline down the center of the strip. Then cut the strips into ½" lengths to give you ½" square pieces, (a convenient size for handling). To make the centerfold ticks, scribe crossing lines at ½" intervals at right angles to the first line before cutting the strips into ½" squares.

The tick marks are printed on the plate by cutting a small window in the flat to expose the scribed line just as the image area of the negatives are exposed.

Stripping Bleeding Images

If the image is to bleed (run off the page when the job is trimmed), the window cut in the flat should extend 1/8" beyond the trim line, as shown in figure 9-21. If an image is to bleed into the gutter (center margin) in bookwork, the window should be cut so that the image will end exactly on the centerline when the sheet is folded. If part of a halftone is to be printed on one page and part of it on a facing page, you should allow the negative to extend through the



57.621

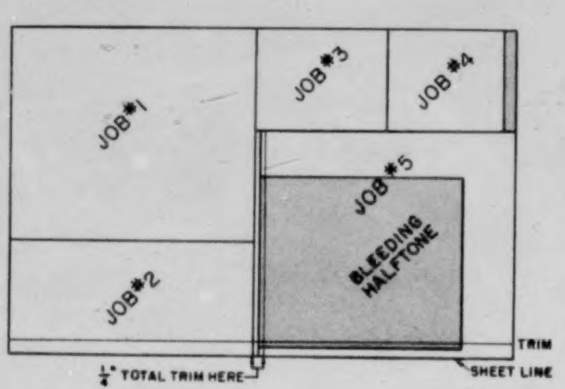
Figure 9-21.—The window for a bleed illustration should extend 1/8" beyond the trim line of the layout so that 1/8" of the illustration will trim off the page to ensure that the page will bleed.

gutter across both pages if the pages will occur in the exact center of the book when it is bound. If the facing pages are not in the exact center of the book, they will likely be separated rather than in adjacent positions on the flat. In fact, they may even be located on separate flats. In this case, you should still use only one halftone negative, since it is difficult to match the parts of the illustrations if you make two separate halftone shots. Cut the window for the halftone illustration in the space allotted on the first page on which it is to appear, allowing it to run into the gutter beyond the text margin to the centerline where the sheet will be folded. Cut a similar opening for the illustration on the other page on which it is to appear. You can then either cut the halftone and strip part of it on one page and part on the other, or you can strip the entire halftone illustration in place in the first opening. The platemaker will then mask off the remainder of the flat while he makes his first exposure. He will then move the negative to the second opening and again mask off the remainder of the flat while he makes his second exposure. He then has two matching exposures from the same halftone negative. As a final operation, he will mask off the two halftone windows and make a third exposure for the other material that is to go on the plate.

As you have already seen, in bookwork, it is sometimes necessary to cut and trim the pages after the job is run. The binderyman cuts the signature once to separate the pages and then cuts the pages again to final trim size after the book is assembled. If bleed is involved, double trims are also required when several jobs are ganged together on the same flat. You should allow 1/4" trim margin between jobs when one requires trim for bleeding and add two sets of trim marks, one showing the first cut and the other showing the final trim. Then extend your negative 1/8" over your final trim size. (See fig. 9-22.) This procedure will provide the proper bleed without danger of running over into the adjoining job. If the job is to bleed along the gripper edge in a gang layout, it is better to allow extra trim space for all jobs placed along the gripper edge of the press sheet.

Splicing Negatives Together

Since the photographic processes are different, line and halftone negatives are always shot separately and then the two negatives are spliced together when it is necessary to use them together. Two line negatives may also require splicing if they have been photographed at different camera settings. The smaller negative, when it is spliced into a master or main negative, is called an insert.



57.622

Figure 9-22.—Ganged jobs on a press sheet, showing the trim required to separate a bleeding job from the others. Note that 1/8" of the bleeding job trims off and that 1/4" separates the bleeding job from the edges of the other jobs.

As a rule, it is best to splice the smaller negative into the main negative before it is attached to the flat. To cut in the insert, you should tape a piece of clear glass to your light table glass and tape the main negative to this glass. Then tape the insert in the proper position over the main negative. Next, cut through both the main and insert negatives in a single cut, using a metal straightedge as a guide. Press down firmly on the straightedge to prevent the negatives from slipping as you make the cut.

When you have finished cutting the insert into the main negative, remove it from the piece of glass which served as the cutting base. Next, place the main negative, emulsion side down, on the light table glass and position the insert, also emulsion side down, into the cutout of the main negative. Attach the insert to the main negative with narrow pieces of lithographer's tape, ensuring that you don't overlap the image area with the tape. If any of the tape is in the image area, it must be cut away or the tape will mask off the image. When the two images are so close that a narrow strip of lithographer's tape cannot be used, you may use clear, transparent tape as long as you opaque along the splice lines. Don't let the tape overlap, or you will find that it will cause poor contact between the negative and the plate when the plate is "burned" (exposed).

You may also splice two line negatives together, when you need to make a minor change to a page. It is best to make such changes to the original copy and re-shoot it, however, because negatives shot under different circumstances will seldom be exactly alike.

DOUBLE PRINTING

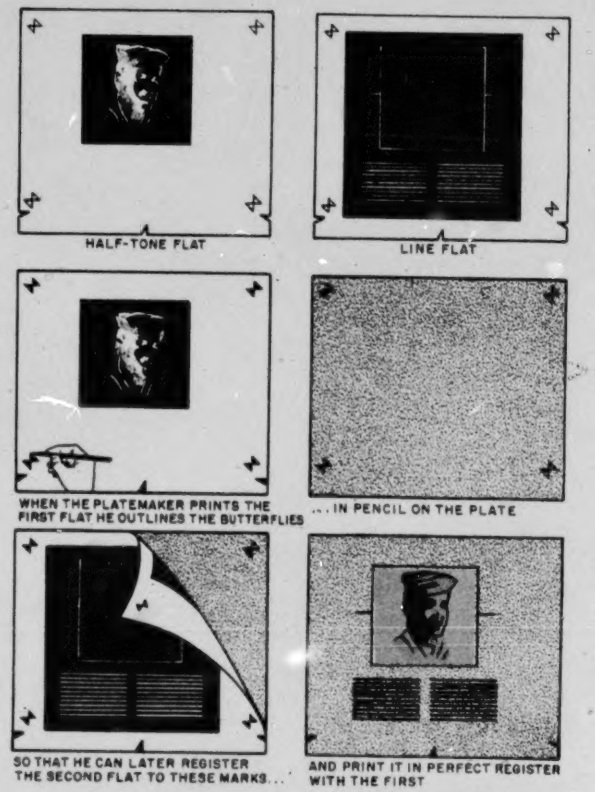
Sometimes because of the nature of the job it is not possible to splice the insert into the master negative. In this case, you may strip the main negative on one flat and the insert on another and the platemaker will then combine the printing detail of the two negatives by printing them one after the other on the plate in exact register. This is known as "double printing" or "double burning."

At times, it may also be desirable to print black lettering or other line work over a tone area. This is known as "surprinting." When stripping for a surprint, you must also prepare two flats. The platemaker will then print one flat on the plate for the tone and will print the other flat for the line detail.

When preparing flats for double printing or surprints, you should strip your main negative on the goldenrod sheet first. You can then use this flat as a master. Fasten it to the light table and position another sheet of goldenrod over it. Strip up the insert or surprint on the second sheet in perfect registration with the main negative. Finally, cut crossmarks (butterflies) like those shown in figure 9-23 through both goldenrod sheets. You should cut at least two butterflies along each side or at the top and bottom of the layout.

Attaining Register

When the platemaker prints the main flat, he will outline the butterflies in pencil on the plate. He can then match the butterflies on the second flat to the pencil marks on the plate to obtain registration when he prints the second flat. (Instead of outlining the registration marks with pencil, the platemaker may print them on the plate when he exposes the main negative and then develop them locally before exposing the second negative. He can then use the developed out marks in registering the second flat. To eliminate the local developing, some strippers attach strips of Vandyke paper to the plate under the register marks. This paper turns brown when exposed to the light. You will learn more about it later in this chapter in the discussion of proofs.)

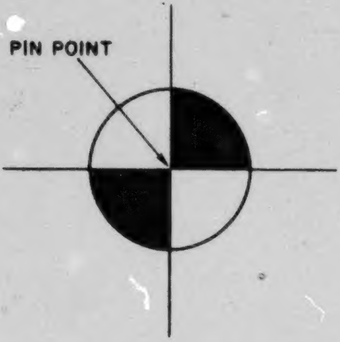

HALF-TONE FLAT
LINE FLAT
WHEN THE PLATEMAKER PRINTS THE FIRST FLAT HE OUTLINES THE BUTTERFLIES
... IN PENCIL ON THE PLATE
SO THAT HE CAN LATER REGISTER THE SECOND FLAT TO THESE MARKS...
AND PRINT IT IN PERFECT REGISTER WITH THE FIRST

57.165

Figure 9-23.—Double printing, or double burning, two flats in register on one plate.

Film Register Marks

Film register marks, like those shown in figure 9-24, are more accurate than the butterflies.



57.623
Figure 9-24.—Film register mark.

They have two points of registration: the pin point at the center of the crossmarks and the circle. Marks of this type are more difficult for the platemaker to use, however, because he must aline them with a magnifying glass when he exposes the second flat. These marks are provided as film tabs and you should tape these tabs in position on at least three sides of the key flat. After you tape your second flat over your key flat on the light table, you should cut openings in the second flat to correspond to the marks on the key flat. You can then position a register mark in each opening and aline it with the register mark in the key flat. Tape the marks in position. Complete the second flat by registering the surprint negative and taping it into position.

Pin Register

Still another system may be used when large flats or close registration is involved. This system involves the use of small tabs of acetate with prepunched holes and a set of plastic pins or buttons like those shown in figure 9-25.

When the operator prepares his first flat, he strips one of the hole tabs on each side of the goldenrod sheet. (He generally strips the tabs near the gripper edge of the flat so they won't interfere with the image areas.) Once this has been done, he inserts the plastic pins through the holes in the tabs and then positions a second sheet of goldenrod over the first flat, stripping in another set of hole tabs on this sheet in exact register with those stripped into the first. He then slips the second goldenrod sheet down over the pins to prevent it from slipping while he strips up the negatives for the second flat.

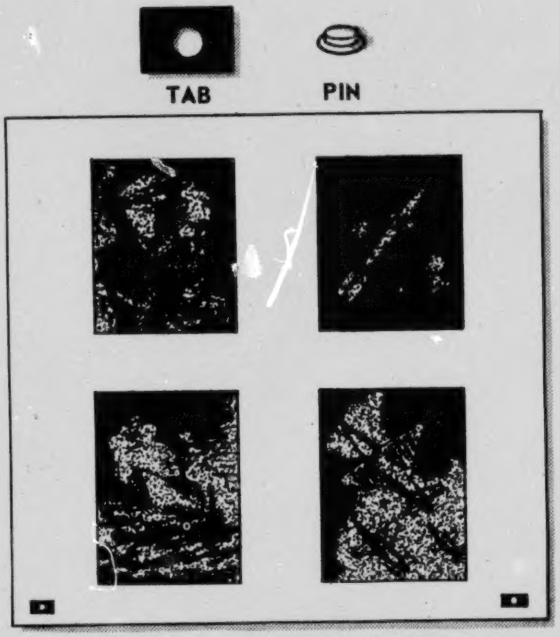
The platemaker uses a similar set of pins for positioning the work on the plate when he makes his exposures. He slips his pins through the hole tabs and allows them to lay loose on the plate until after he has positioned his first flat. Once the flat is in place, he secures the pins by taping them to the plate with masking tape.

After he makes his first exposure, he removes the flat and then positions the second flat on the plate, fitting it over the pins so that the details of the surprint will register with those of the main negative when the second exposure is made.

There are many variations of the tab and pin system. In some cases, holes are punched in the plate as well as the flats. These holes are punched on a punch table equipped with individual punches along the gripper and side edges.

Printing on Film

If your darkroom is equipped with a vacuum printing frame, you may find it simpler to



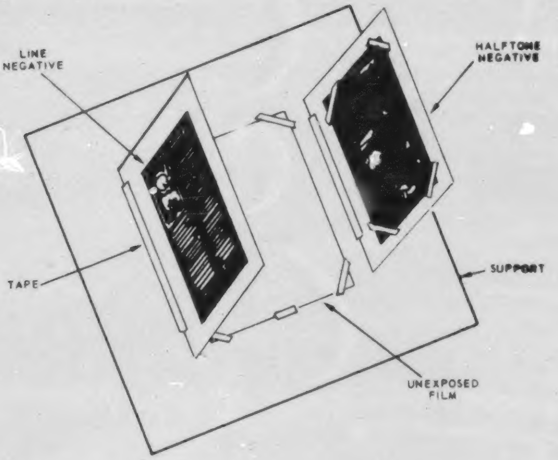
FLAT WITH TABS STRIPPED IN PLACE

57.166
Figure 9-25.—Pin and tab register method.

prepare surprints on a sheet of film rather than to prepare two flats. If you combine close-fitting line and halftone images on a single piece of film, you will also eliminate the possibility of out-of-contact areas when the plate is printed.

Printing negatives on film will produce film positives and you will have to reprint these positives on another sheet of film to produce negatives, of course, unless you use duplicating film which produces film positives from positives and negatives from negative images. You have already seen how this film works in chapter 6 of this book.

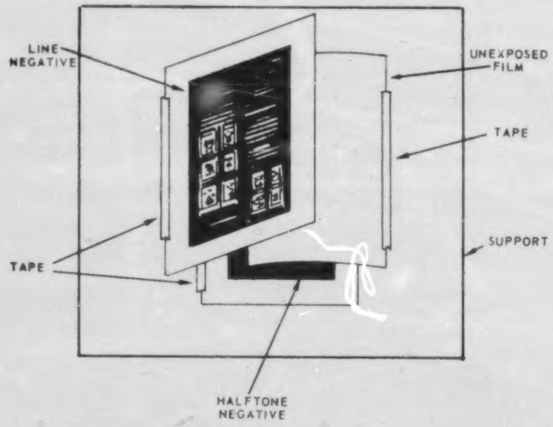
Figure 9-26 shows one method of double printing on film. As you can see, you simply prepare one flap for your line negative and another flap for your halftone negative. Register the two images and tape the flats (along the edge) to a thin, metal supporting base, such as a piece of press plate. Then tape your unexposed film, emulsion side up, on the base. Place the assembly in the vacuum printing frame. Fold one flap back out of the way and fold the other flap against the film. Make the exposure, using a pin-point light source. Then open the vacuum frame, fold back the first flap, move the second flap in place over the film and make your second exposure.



57.624

Figure 9-26.–One method of combining line and halftone images on a single piece of film.

If the film is so large that you cannot fold it back in the vacuum frame, you can use the arrangement shown in figure 9-27. In this case you hinge both flaps to the same side of the support base and hinge the film to the other side. You then insert the film between the first and second flaps and make your first exposure. After this, remove the top flap and slip the film under the second flap and make your second exposure.



57.625

Figure 9-27.–Another method of printing line and half tone images on a single piece of film.

Instead of using the flap method, some shops punch the film and then register it over a set of pins.

REVERSE LETTERING

Effects, such as reverse lettering (white lettering against a dark background) require a film positive of the lettering. This film positive is generally made on thin base film and is stripped on the same flat as the main negative so that it overprints the main negative on the plate. When stripping line negatives against tone areas, you should arrange the work so that the tone negative will be in direct contact with the plate when the exposure is made. This arrangement will keep the light from spreading and produce a sharper dot formation on the plate.

The film positive must always be as large or larger than the negative it is to cover so that it will not leave a shadow or edge when the plate is printed.

TINT AREAS

Although the cameraman may provide tints by photographing a sheet of white paper through the halftone screen, many shops use commercial tints which are available in rolls or sheets in values ranging from 10 to 80 percent and in screen rulings measuring from 50 to 175 lines.

Tints are available in standard angles of 15, 45, 75, and 90 degrees. You may use a 45-degree angle in cases where only one color is involved, but if the job calls for a tint of one color to be printed over a tint of another color, you should use a different angle for each color, just as you would vary the angle if you were producing halftone color-separation negatives.

If you are using only two colors, you should use a 45-degree angle for your strongest color and a 15- or 75-degree angle for the other one. If you are running four colors, you should use a 15-degree angle for blue, a 45-degree angle for black a 75-degree angle for red, and a 90-degree angle for yellow. The angle and other information is generally shown in the margin of the sheet on commercial tints.

As you have seen in chapter 4, when a tint is required, the copy preparer may paste a piece of black paper over the desired area of the copy or he may fill in the area with India ink. The filled-in area will photograph as a transparent window on the negative.

In some cases, the copy preparer may simply outline the area for the tint on the layout with india or red ink and indicate that a tint is to go in the area by marking in instructions on a tissue overlay. In such cases, it will be necessary for you to cut a window in the main negative, using the lines ruled in by the copy preparer as a guide. The tint film should overlap the edges of the window by at least 1/4". And it should be taped to the main negative in such a manner that the emulsion side of the tint will be in direct contact with the plate when the exposure is made. Flat tints may create contact problems when the plate is exposed if they are not handled properly. Several thicknesses of tape, for example, may prevent proper contact and cause a dark rim or halo around the outer edges of the tint area when it is printed on the plate. You are more likely to have out-of-contact areas if you cut windows in the main negative than if clear openings are provided on the negative in the tint areas.

To eliminate out-of-contact troubles some operators treat tints as surprints instead of stripping them into or over the main negative.

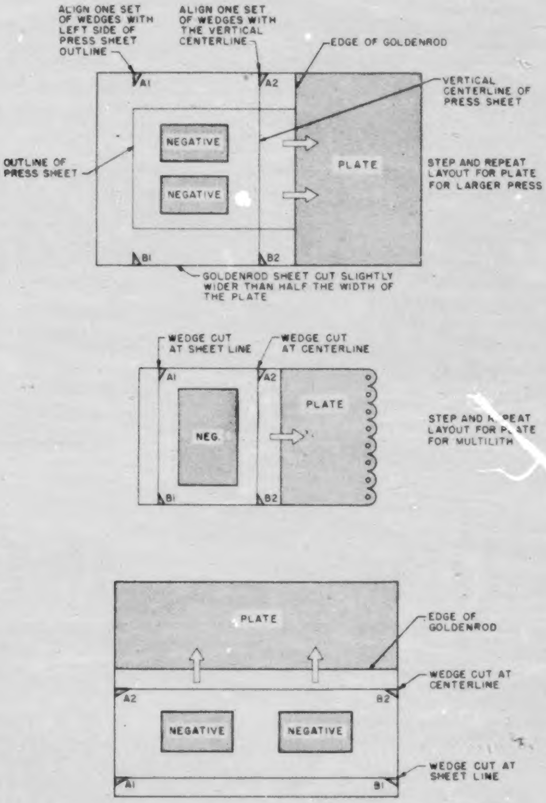
STEP AND REPEAT WORK

As you know, it is frequently desirable to run a job two or more up on the plate. This means that additional negatives must be used or that one set of negatives must be printed in two or more different positions on the plate.

If the job is very simple, it may be better to make several negatives from the original copy, but if halftones, inserts, or complicated stripping operations are required, it is usually better to make two or more exposures on the plate from the same set of negatives. This is called step-and-repeat work. There are several ways that it can be done.

The illustration at the top of figure 9-28 shows one method of repeating the job on the plate. In this case, the stripper rules up the goldenrod in the regular manner, locating the vertical centerline and the press sheet outline. He also rules in any additional lines needed on the left side of the layout for positioning the negatives. It is not necessary to rule up the right side of the goldenrod because he cuts this side of the sheet off (slightly to the right of the centerline) before he sends the flat to the platemaker. If he did not do this, when working with large flats the goldenrod might project beyond the edge of the vacuum frame when the platemaker moved the flat for the second exposure on the plate.

The stripper strips up the negatives in the regular manner on the left side of the flat. He then cuts in two sets of wedges—one set along the left edge of the press sheet outline and one along the vertical centerline, as shown in figure 9-28.


ALIGN ONE SET OF WEDGES WITH LEFT SIDE OF PRESS SHEET OUTLINE
ALIGN ONE SET OF WEDGES WITH THE VERTICAL CENTERLINE
EDGE OF GOLDENROD
VERTICAL CENTERLINE OF PRESS SHEET
A1
A2
NEGATIVE
NEGATIVE
PLATE
OUTLINE OF PRESS SHEET
STEP AND REPEAT LAYOUT FOR PLATE FOR LARGER PRESS
B1
B2
GOLDENROD SHEET CUT SLIGHTLY WIDER THAN HALF THE WIDTH OF THE PLATE
WEDGE CUT AT SHEET LINE
WEDGE CUT AT CENTERLINE
A1
A2
PLATE
NEG.
STEP AND REPEAT LAYOUT FOR PLATE FOR MULTILITH
B1
B2
PLATE
EDGE OF GOLDENROD
WEDGE CUT AT CENTERLINE
A2
B2
NEGATIVE
NEGATIVE
WEDGE CUT AT SHEET LINE
A1
B1

57.167

Figure 9-28.—Step-and-repeat flats. The platemaker moves the flat from the A-1 and B-1 position after the first exposure to A-2 and B-2 position for the second exposure. The uncovered portion of the plate must be masked for each exposure.

He then sends the flat to the platemaker, who aligns it with the gripper and left edge of the plate and makes his first exposure. Before the first exposure, the platemaker takes a sharp pencil and traces the outline of the two centerline wedges on the plate. After the first exposure, he moves the flat to the right side of the plate and alines the wedges cut along the outline of the press sheet with the pencil marks on the plate. This enables him to position the flat properly for the second exposure. This is known as making a "step-over" exposure.

The illustration at the bottom of figure 9-28 shows another method of repeating the job on the plate. It is essentially the same as the one just described, except that the flat is moved from the gripper toward the trailing edge of the plate for the second exposure, and the register wedges are cut into the flat at the sheetline and at the horizontal centerline. This is known as making a "step-up" exposure.

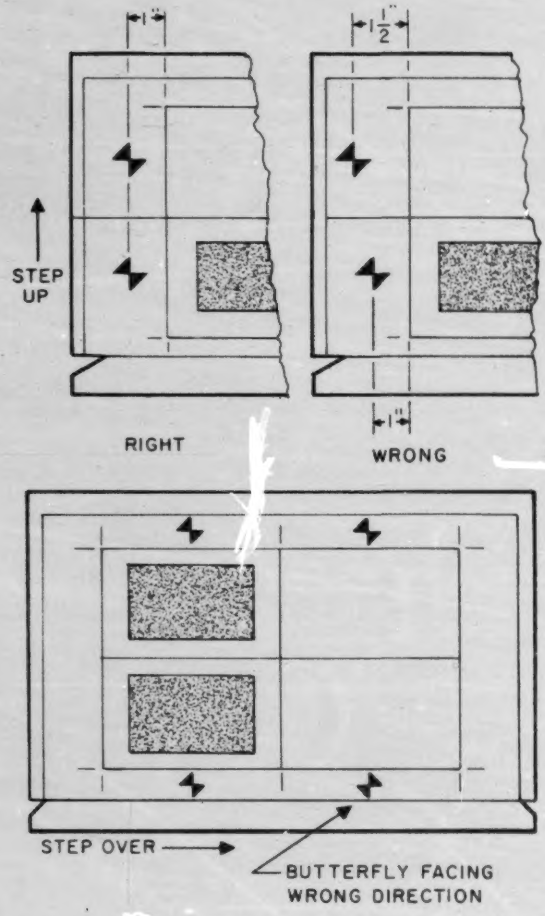
Instead of using the wedges just described, some strippers cut butterflies into the layout and the platemaker outlines them in pencil on the plate when he makes his exposures. The tab and pin system or the film register marks described in the discussion on surprinting may also be used for registering the flat in step-and-repeat work. If you use butterflies, always be sure they are the same distance from the trim margins of the paper and also that they are all angled properly. (See fig. 9-29.)

Figure 9-30 shows how to make a work-and-twist layout. Notice that the register marks are placed on the vertical centerline at equal distances from the horizontal centerline of the press sheet. Only one set of register marks is required for positioning the flat during the exposures. Figure 9-31 shows how to prepare a layout for repeating the image four times on the plate.

If a surprint or double burn is involved in a step-and-repeat layout, the same registration marks must be cut in the flat for the surprint as are used in the flat for the main negative in order for the platemaker to obtain proper register. In some cases the surprint and main negative are overprinted on film in the vacuum frame to combine the printing details of both on a single negative. You have already seen how this is done.

PHOTOCOMPOSING MACHINE

In plants specializing in chart and map work, labels and small forms, photocomposing machines are used for step-and-repeat work and combination work. These machines are not to be confused with the photocomposing (typesetting) machines discussed in chapters 3 and 4. They consist of a printing frame (negative carrier) which may be moved about over a bed supporting the sensitized plate. They are built to register to one thousandth of an inch (0.001"). (See fig. 9-32.)



57.626

Figure 9-29.—Be sure that the butterflies are properly aligned and facing in the right direction at each point on the flat.

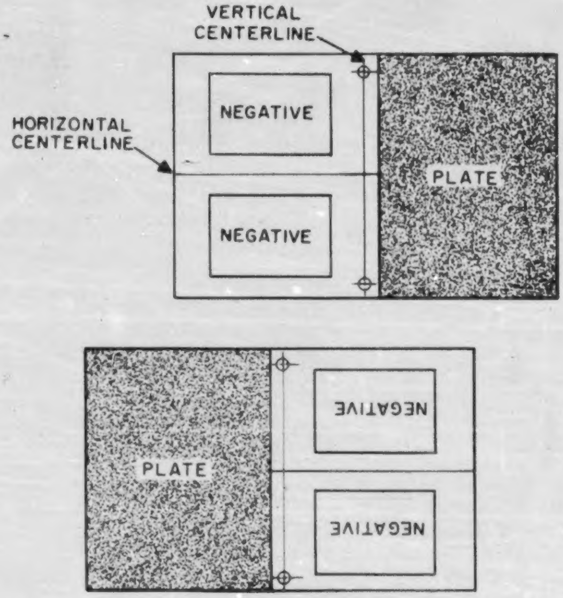
STRIPPING FOR COLOR

If you are stripping up a simple line color job where the colors do not overlap, you may use only one flat and have the platemaker mask out on the negatives those areas that are not to print as he makes the plates for each color.

If the colors are to overlap, it will be necessary to make up a set of flats, of course. In this case, you may use the flat for the main color as the master for the others. Line up the main (key) flat on the light table and then strip up the flats for the other colors by the same method that you use in stripping up flats for surprinting. You should include reference marks (+) on all flats to be used as guides in registering the work on the press. You can cut these registration marks into the goldenrod stock or you can use register marks on tabs of film.

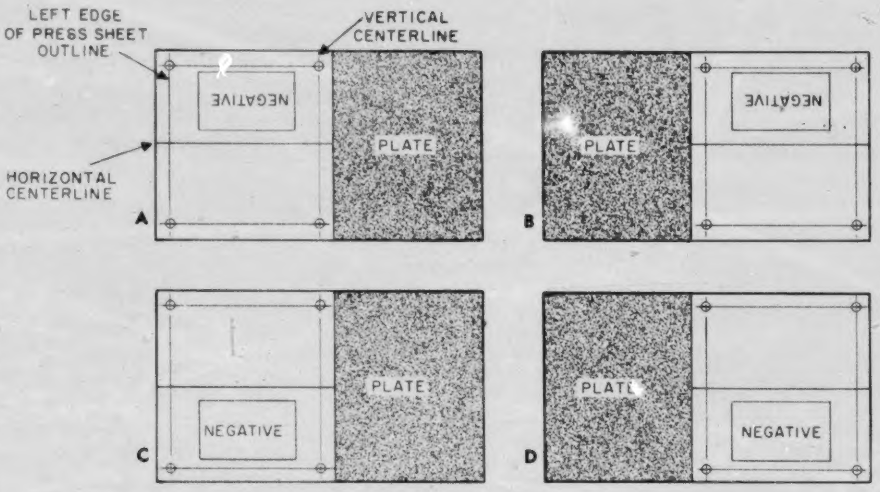
Layouts for color register are difficult to prepare because paper stock does not maintain accurate dimensions under certain weather conditions. You may use the following method in making up layouts for close-register work.

Strip up a key flat containing all the printing detail and reference marks that will be required for the entire job and turn it over to the platemaker. He will use it to prepare as many copies of the master as are required on separate sheets of glass or acetate which have been coated with a blueprint solution that develops out into a light blue positive image. Since the light passes through these blue lines readily, you can simply tape the film over the blueline images as you



57.627

Figure 9-30.—Work-and-twist flat. Note that only two sets of register marks are required. They should be placed along the vertical centerline equidistant from the horizontal centerline.



57.628
Figure 9-31.–Layout and platemaking procedure for repeating one image four times on a plate. As each exposure is made, the uncovered portions of the plate must be masked off.

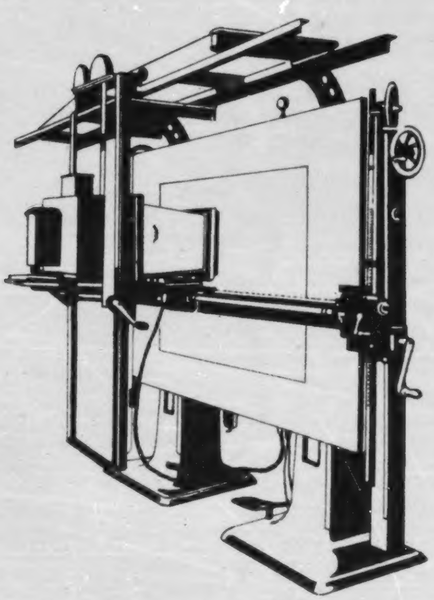
prepare each flat. Mask off the remaining areas with goldenrod paper.

Stripping for Positive Working Plates

As you have seen earlier in this chapter, some types of plates are made from film positives rather than negatives. Stripping operations vary from those just described when film positives are used, of course.

You already know how positives can be made on film by exposure in a vacuum frame. In film positive work, the negatives are assembled and stripped together in complete units or in the largest possible sections before the film positives are made.

The positive film units may then be used without a support or they may be attached to a sheet of acetate or glass. If they are used without a support, they should be taped together with the readable side up in the position that they are to print on the plate, because they will not be reversed or turned over when the plate is printed. If they are to be used on a support, they should be taped with the unreadable side up.



57.168
Figure 9-32.–Step-and-repeat machines, similar to this, are used to produce plates for maps and charts and label work.

It is best to allow the edges of the film to overlap. You can cut through two overlapping edges with one cut of a razor blade along a steel straightedge. Then when the trim is removed, the edges of both positives will be snugly butted together. They can then be taped on the readable side. You should use transparent tape when working with film positives, of course. Polyester tapes are often used because they are less likely to leave a shadow when the plate is printed. When working with tints, many operators cut the tint to size and then apply it to the layout with rubber cement instead of taping it since clear tape is liable to leave a shadow in the tint area.

No masking is necessary for film positive layouts. The layout is simply placed in the proper exposure position on the plate and the exposure is made. The platemaker may then mask off the printing areas of the plate and make an additional exposure to burn out undesirable shadows or markings in the nonprinting areas. He may also paint or "stage" these markings out by hand before he develops the plate. You will learn more about the various platemaking methods in chapter 10.

PROOFS

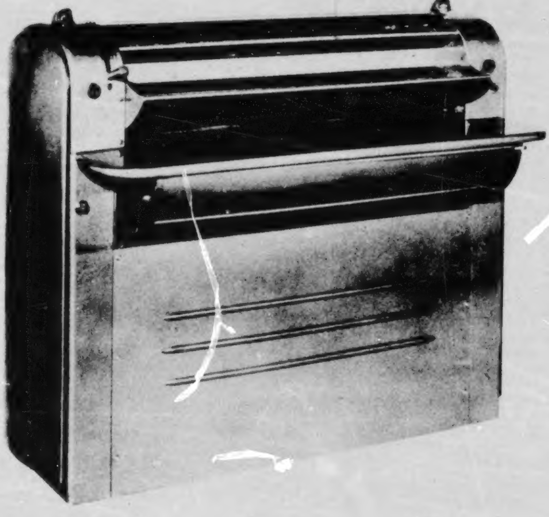
You can make proofs from your flats on blueprint or Vandyke (silverprint) paper. You can make these blueprint or silverprint proofs by exposing the paper through a negative layout in a vacuum frame for about 4 or 5 minutes—until the paper turns blue or brown as the case may be. These prints should be kept out of strong light unless they are fixed. Silverprints are fixed in hypo and blueprints are fixed in a solution of potassium ferricyanide.

You can make color proofs on a sheet of Vandyke paper by successively exposing the color separation negatives in register on it. Hold the paper in contact with the negatives in the vacuum frame. Expose each negative for a different length of time so you can identify the separations by the different shades of brown.

(When printing surprints or step-and-repeat work, some platemakers tape tabs of Vandyke paper to the plate and allow the butterflies or film register marks to print on these tabs. They then register succeeding flats to the marks on the tabs. The paper tabs are removed before the plate goes to press, of course. This system eliminates the necessity of developing the marks out and removing them later from the plate.)

The 3-M Company produces thin, light-sensitive, color-coated acetate sheets which may be used in proofing color jobs. The colored coatings on these sheets match standard printers' inks. The sheets are exposed to light through the proper separation negatives and are then developed with a chemical which dissolves the unexposed areas of the coating, leaving a colored image on the acetate. Since the colors are transparent, when sheets with a magenta, cyan, yellow, and black image are registered one over another, a full-color proof results. These sheets may also be used for proofing individual black-and-white halftones.

A diazo machine, such as the Ozalid, Comet, Pease, or Copyflex may be used for making proofs from film positives. (See figure 9-33.)



45.296(57)

Figure 9-33.—A diazo machine.

Diazo paper is coated with a light-sensitive dye that can be decomposed or bleached by light. A mercury vapor lamp exposes the paper through the film as the two pass around a glass drum. Part of this dye is bleached out by the light and the remaining dye is then darkened by ammonia fumes or with a special developer as the paper continues through the machine. These machines ordinarily produce positive copies from positives and negatives from negatives, although special papers are available that make it possible to produce positive prints from negatives and vice versa.

AFTER STUDYING THIS CHAPTER, YOU SHOULD BE ABLE TO UNDERSTAND THE FOLLOWING TERMS AND THEIR APPLICATIONS IN YOUR WORK AS A LITHOGRAPHER:

- Goldenrod
- Negative Corrections
- Layout and Flats
- Gripper Margins
- Ganging of Work
- Impositions
- Step-and-Repeat Flats

CHAPTER 10

PLATEMAKING

The plate is the heart of the lithographic process. It's function is based on the principle of lithography that grease (ink) and water will not mix. The image areas of a plate accept ink, but reject water. The non-image areas of the plate react in the opposite: they accept water but reject ink. The greater the difference between the ink and water receptivity of the two areas, the better the plate will perform on the press.

EARLY PLATES

Limestone stabs were originally used as a base for lithographic images. As rotary presses replaced the slow, cumbersome, stone flatbed presses, limestone gave way to metal plates (monel, stainless steel, zinc, chromium, copper, or aluminum). The use of rotary presses meant faster output, better impressions, and improved working conditions for pressmen. The rotary presses led the way into offset printing and the metal plates remained the carrier of the inked image.

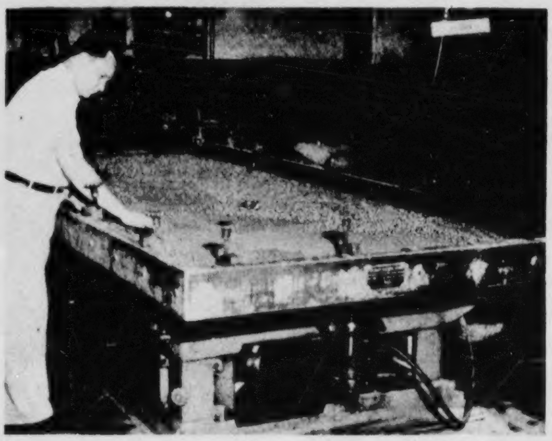
Offset presses were continually improved, but for years metal plates created problems. Platemaking was a process of trial and error. Platemakers adopted and discarded many steps and processes in search of a reliable offset plate.

Metal plates were not porous, as were the limestone slabs, and it was necessary to grind them with abrasives to produce a roughened (grained) surface that would hold water and ink. One method of graining the metal plate or regraining the more durable plates for reuse was accomplished by the use of a graining machine shown in figure 10-1. The plate was fastened to the bed and covered with steel, glass, or wooden marbles. Water and an abrasive such as carborundum, aluminum oxide, or quartz was added. When the machine was turned on, the bed vibrated in an eccentric motion causing the marbles to roll, crush the abrasive, and pit (roughen) the surface of the plate. Other processes of graining evolved and include brush graining, dry sandblasting, and wet sandblasting.

It wasn't until the mid-1950's, when the first presensitized aluminum plates were introduced, that the trade obtained a plate that was easily processed and produced a constant high quality image. The costs associated with platemaking were also lowered by the use of these plates. What formerly was a highly specialized operation, became within reach of each shop.

Today, presensitized aluminum plates remain the standard of the industry. However, continuing research and development has brought other types of plates and platemaking processes into widespread use.

As you become familiar with the various types of plates, you will see that there isn't any



57.176

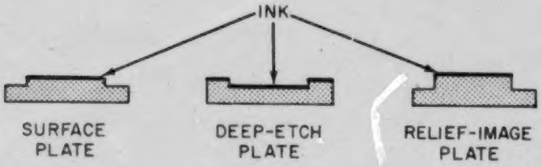
Figure 10-1.—Metal plates were grained in equipment similar to this before the introduction of presensitized plates.

type of plate which fills every printing requirement. You'll find some plates are too expensive for certain types of work; others may not be capable of reproducing the quality needed; and still others may not have sufficient press life to complete an extended run.

In this chapter, the characteristics of plates and platemaking processes in use in the Navy are presented. This information will help you to select the correct plate for the printing requirements in your day-to-day work.

MAIN TYPES OF PLATES

Basically, all plates fall into one of three categories: surface plates which have a flat image formed on the surface of the plate; deep-etch plates which have an image etched slightly beneath the surface of the plate; and relief plates which have the background etched out slightly, so that the image stands above the surface of the plate. (See figure 10-2.)



57.171(57C)
Figure 10-2.—The three basic plate categories.

SURFACE PLATES

There are several types of surface plates, but presensitized and wipe-on aluminum are the ones most commonly used.

Presensitized Plates

These plates are generally of plastic or aluminum and have little or no grain. They are coated by the manufacturer and come to the platemaker ready for use. After the job is completed, they cannot be regrained and used again. However, they are often coated on both sides so that each side of the plate can be used for printing. These plates are coated with a diazo compound which is an aromatic nitrogen by-product of coal tar that is sensitive to light. Plates are available for use with both negatives and positives. If negatives are used, the plate is exposed and then developed with a solution which dissolves the coating in the nonprinting areas. After this the image areas are covered with a special lacquer emulsion and the plate is gummed. A slightly different procedure must be followed in processing positive-working plates. A film positive is used in printing the plate, and the plate is developed in a special developing solution. In this case, however, the image is still sensitive to light, so it must be "fixed" if the plate is not to be put on the press immediately. After development, the plate is washed in running water and is then fixed with a solution which stops all action of the developer. The image is then lacquered with a lacquer emulsion and the plate is gummed and dried. Lacquer is a vinyl resin that strengthens the image and makes it resistant to the action of solvents, acids, and gums. A lacquer emulsion is used on presensitized and wipe-on plates. It contains a lacquer resin and a desensitizing gum which is deposited on the nonprinting areas of the plate.

These plates are used extensively throughout the industry and are used almost exclusively aboard ship.

There is another type of presensitized plate that is very popular in commercial shops when long runs are involved. Instead of the diazo coating, it utilizes a light-sensitive photopolymer coating made of plastics or lacquer. Plates made with this type of coating are good for 100,000 impressions or more. These plates use different chemistry and a different processing procedure than the diazo coated plates previously mentioned. Some photopolymer plates are exposed to ultraviolet light which causes the image areas to become insoluble and ink receptive without lacquering or further processing.

Wipe-On Plates

You have just seen that the coatings on presensitized plates are applied by the manufacturer. Wipe-on plates differ, in that the coating in this case is mixed in the print shop and applied by print shop personnel.

Wipe-on coatings may consist of casein or albumin solution or of a diazo compound similar to that used on presensitized plates. The plates are usually brush-grained or chemically treated aluminum plates. Since diazo chemicals react with the metal of the plate, the manufacturer applies a barrier coating to the surface of the metal plates to prevent the wipe-on solution from contacting the plate itself. For this reason the diazo coatings can be applied only to new plates, because regraining to remove the old image on a used plate destroys the "barrier" coating. Regraining may also cause the surface of the plate to become too rough to give good coverage with the thin wipe-on coating.

Wipe-on coatings are wiped over the plate with a swab of cheesecloth or specially-treated cotton, or it is applied by passing the plate between a set of rollers which revolve in a tray of coating solution. Coatings may also be flowed over a plate which is slightly tilted to facilitate the spreading of the solution and to allow it to drain off. It may also be applied with a vertical whirler as shown in figure 10-3.

57.179

Figure 10-3.—Coating a plate in a vertical whirler.

Processing depends on the type of coating used. Plates coated with a diazo solution are processed and run on the press in the same manner as presensitized plates. Presensitized plates have a definite shelf life, of course, while unsensitized wipe-on plates can be stored indefinitely and the wipe-on coatings can be applied as they are needed.

Electrostatic Plates

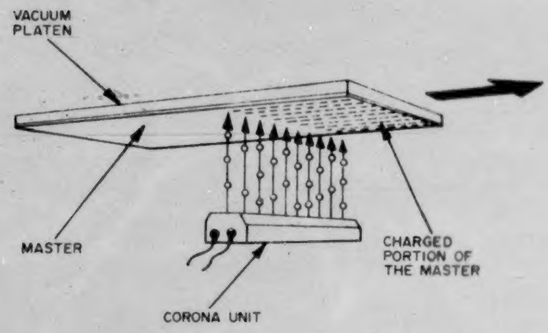
Electrostatic plates are made in a camera and processor combined. Cut plates or rolls of plate material are used in these machines. In most cases the plate material is covered with zinc oxide, but this is not true in all cases.

Before starting the platemaking cycle, the platemaker positions the copy on the copyboard (or face down against a sheet of glass). If necessary, he sets the copyboard and lensboard for the proper amount of enlargement or reduction. (Some camera-processors can only produce same-size images.) He also sets a timer to control the length of the exposure. Once these steps have been completed, the remainder of the process is entirely automatic..

When the platemaker depresses the switch and closes the copyboard cover to start the platemaking cycle, the cut plate or roll of plate material is fed into the machine. (If a roll is used, it is automatically cut after the proper length has been fed through.) The plate material then passes under a series of electrical discharge wires called a corona unit. The corona wires glow from a charge of high voltage electricity, causing the air around them to be ionized. The plate is bombarded by electrons as it passes under these wires and its zinc oxide coating picks up a negative charge of static electricity. (See fig. 10-4.)

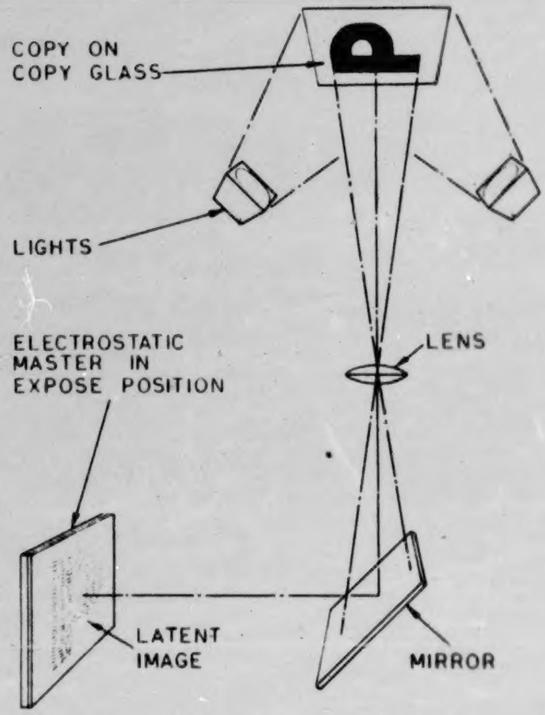
The charged plate is then moved into exposure position in the camera. The exposure is made automatically, the length of time being controlled by the timer which the operator has previously set. During the exposure, the plate loses its electrical charge wherever it is struck by light (in the non-printing areas) but remains charged in the image areas. The plate now carries a kind of electrical image. (See fig. 10-5.)

After the exposure the plate is carried through a toning unit, as shown in fig. 10-6,


VACUUM PLATEN
MASTER
CHARGED PORTION OF THE MASTER
CORONA UNIT

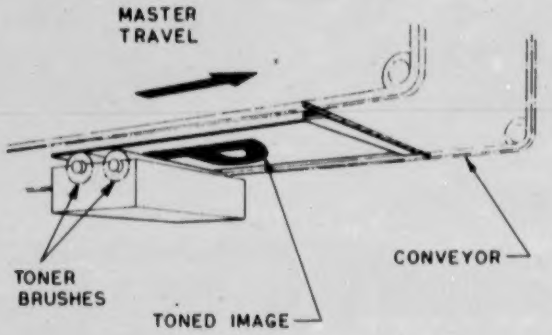
113.123X

Figure 10-4.–When the platemaking cycle begins, the vacuum platen picks up the top plate in the magazine and carries it over a set of corona discharge wires.


COPY ON COPY GLASS
LIGHTS
ELECTROSTATIC MASTER IN EXPOSE POSITION
LENS
LATENT IMAGE
MIRROR

113.124X

Figure 10-5.–The platen turns to a vertical position for the exposure.

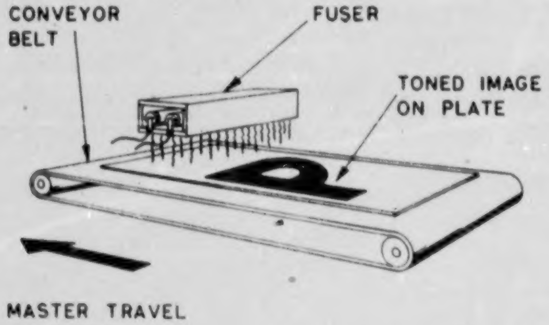

MASTER TRAVEL
TONER BRUSHES
TONED IMAGE
CONVEYOR

113.125X

Figure 10-6.–After exposure, the platen returns to its horizontal position and a set of grippers carry the plate over the toning unit, where the charged image is dusted with a black toning powder.

where the negative charged image is dusted with a black toning powder or covered with a black liquid toner. The toner consists of a carrier powder or liquid and carbon particles which have been given a chemical positive charge. The toner is attracted to the unexposed (image) areas of the plate because they still have their negative charge, but it does not stick to the nonprinting areas which have lost their electrical charge.

If the processing machine uses powdered toner, the plate is passed into a heating unit where the powder is fused to form a permanent image on the plate. (See fig. 10-7.) (On some machines, the plate emerges from the machine and stops at a viewing station after it leaves the toning unit. The operator can then remove any unwanted toner in the nonimage areas or make other deletions with a piece of cotton. He then


CONVEYOR BELT
FUSER
TONED IMAGE ON PLATE
MASTER TRAVEL

113.126X

Figure 10-7.–The toning powder is fused to the plate by heat to make the image permanent.

places it on conveyor tapes and pushes a button to move it into the fuzer.)

In cases where a liquid toner is used instead of the powdered toner, the plate passes through a set of squeegee rollers into a drying unit, and is then ejected from the machine. It is possible to get 100 or 1,000 copies with paper plates produced by the electrostatic process. They can be used for line and coarse (85-100 line) halftones.

The Xerox copying machines operate on the same principle as that described here, except that they do not use the zinc-oxide coated paper. Instead they form their image on a selenium-coated plate and transfer it to ordinary paper where it is fuzed. Some Xerox machines are capable of producing offset masters.

Transfer Plates

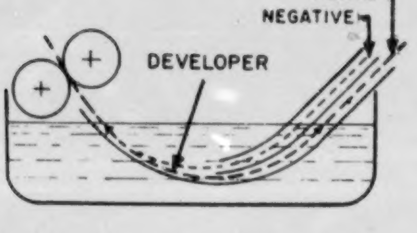
Plates can be made by the diffusion transfer process in a matter of two or three minutes.

The main difference between this platemaking process and the others is that the plate is not coated with a light-sensitive material. Ungrained aluminum or plastic plates are generally used.

A special negative paper is required. However, it is exposed much the same as conventional film and can be used in any camera, contact printer, or enlarger. Exposure is determined by test strips and once it has been determined will remain fairly constant if the camera set-up is not changed.

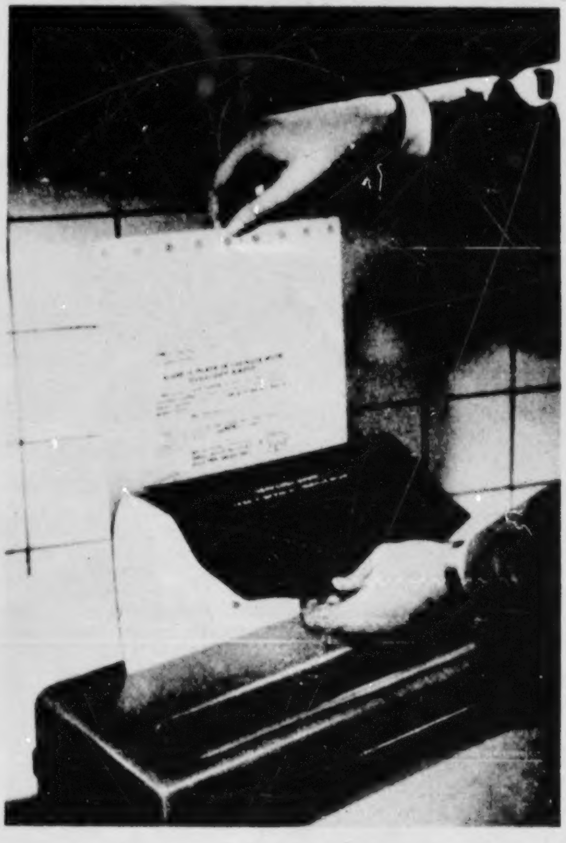
After exposure, the negative and the plate are fed into a machine where they pass through a developing solution and are then pressed together by rollers. (See fig. 10-8.) The developer changes the exposed silver salts to black metallic silver in a matter of seconds. It also loosens the clear, unexposed silver salts and these salts transfer by diffusion to the plate where they blacken to form the image as development continues.

After the plate comes out of the machine, the negative is peeled off (see fig. 10-9) and the plate carries a positive image which must be fixed by swabbing with a chemical solution. The image is then rubbed up with lacquer and the plate is dried and held for the press. These plates are good for reasonably long runs and are not as susceptible to oxidation as other metal plates.



57.194X

Figure 10-8.—Diagram of a diffusion transfer plate developing unit.



57.172X

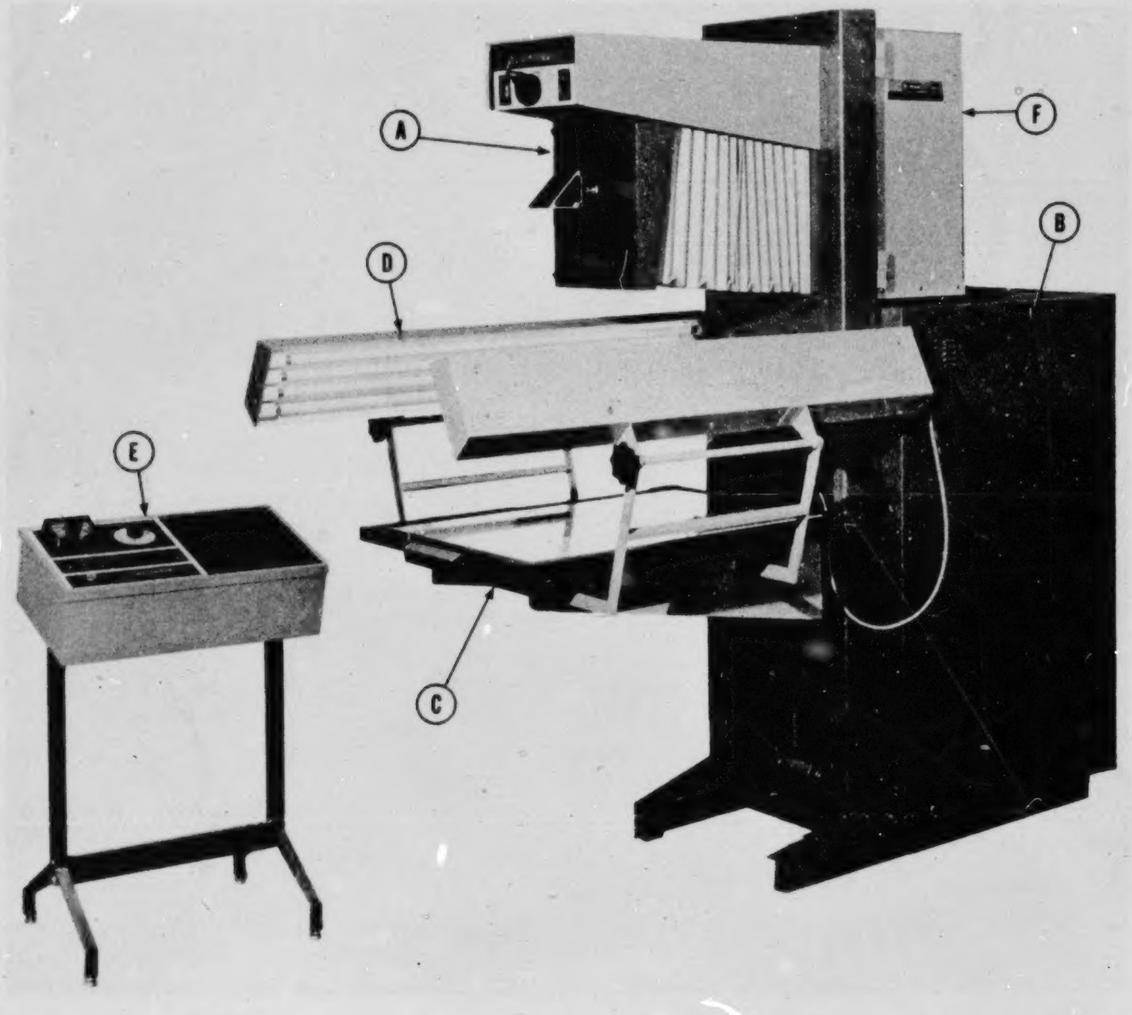
Figure 10-9.—Separating the paper negative from the diffusion transfer plate.

Since they are ungrained they can capture very fine printing detail and will produce halftones made with a 300-line screen.

Camera-Direct Plates

A relatively new entry into the platemaking field is the photo-direct plate processor. These machines feature a camera and a plate processor combined in a single unit. The Itek Platemaster, shown in figure 10-10, is typical of these machines.

The Platemaster automatically photographs reproduction copy and produces a ready-to-run plate bearing a positive image in less than 1 minute. Regular line copy and previously



A. Process camera
B. Processing cabinet
C. Copyboard
D. Lamps
E. Console
F. Magazine which houses plate material

113.111X

Figure 10-10.—The Itek Platemaster (main unit and control console).

screened halftone clippings can be photographed with good results, provided the halftone screen used for the clippings was not finer than 100 lines per inch. The plates produced on the Platemaster are good for 3,000 to 5,000 impressions.

No film is used in making the exposure; the exposure is made on the plate itself and a positive image is produced from positive copy. The plate consists of a three-layer emulsion applied to a polyethylene coated paper base. It has a sensitivity similar to that of ortho film. (See fig. 10-11.) The top layer of the emulsion is a prefogged layer which holds moisture and which (after development) has an affinity for ink. The second layer contains silver halides suspended in gelatin. The bottom layer contains a built-in developer which passes to the top layer during development to bring out the latent ink affinity in the image areas.

During the exposure, the light reflected from the bright areas of the copy produces a latent negative image in the middle layer. After the exposure, the plate passes into an activator solution which develops and hardens the light-affected areas in the middle layer.

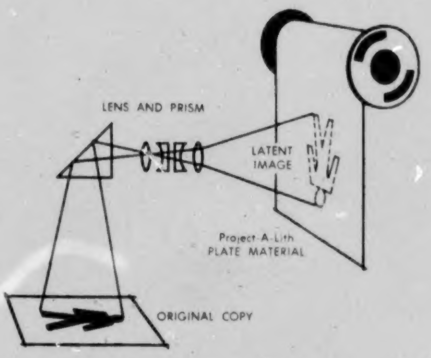
These hardened areas then form a barrier which prevents the passage of the developer from the area below to the area directly above them. And since the developer cannot pass through these hardened areas, the top layer above these areas retains its original moisture-holding characteristics.

The unhardened portions of the middle layer permit passage of the developer from the bottom to the top layer, bringing out the latent ink affinity of these (image) areas.

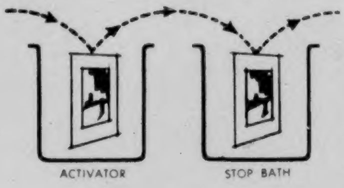
Finally the plate is fixed by immersion in the second processing tank. The fixing solution also provides surface moistening of the correct pH for immediate running on the press without etching.

The plate material comes in a 250-foot roll which is loaded into a magazine at the back of the camera. The material is automatically wound down and cut to plate length when the exposure is made.

After the plate has been exposed and cut, rubber rollers wind it down until it is caught by a series of conveyor belts which carry it through the processing solutions and finally eject it through a slot at the back of the machine.



A prism is used to reverse the image so that it will read correctly on the plate. Plate material is wound down from roll and cut as each plate is made.



After the exposure, plate material automatically passes through processing solutions.

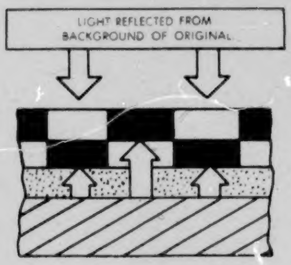


Plate is coated with a three layer emulsion. During processing, middle layer is hardened wherever it was struck by light during the exposure. Developer from bottom layer travels through unhardened areas of the middle layer to make top layer ink-receptive in image areas. Hardened areas in middle layer prevent developer from passing through and prevent top layer from becoming ink-receptive in nonprinting areas.

57.629X

Figure 10-11.—How the Itek Platemaster works. Prefogged top layer of the plate emulsion gives plate an overall grayish appearance.

It is necessary for the platemaker to load the copyboard, set the lens aperture and adjust the copyboard for the proper ratio of enlargement or reduction. He must also make a few preliminary settings, such as setting the timer to control the length of the exposure and setting a dial to control the cutting mechanism so the roll will be cut off to the desired plate length after the exposure is made. But once these settings have been completed, he simply presses the exposure button and from that point on, all operations are entirely automatic. The exposure is made, the plate is wound down, cut, and carried through the processing solutions, and finally ejected ready for use–all in less than 1 minute. Plates can be delivered either wet (for immediate use on the press) or dry. Dried plates must be moistened with water before they are put on the press, of course.

These plates require somewhat critical press adjustments and cannot be used with some fountain solutions and inks. In some shops a press may be set aside and used only for running this type of plate. This eliminates the necessity of changing the press set up that would be involved in switching from one type of plate to another.

Kodak Photo Resist Plates

These plates are a form of the photopolymer plates discussed earlier. Grained zinc or aluminum plates are coated with an organic plastic solution. They are printed from negatives and the image areas are hardened during the exposure. After the exposure, an organic solvent is used to remove the coating from the nonprinting areas. Development is accomplished by flowing the plate with solvent in a whirler. After development, the plate is treated to prevent scum. It is then rubbed up with ink, etched, and gummed. These plates are similar to albumin plates in some respects. However, they are considered superior to albumin plates in that they can be held for a longer period of time between coating and use; they require far less exposure time; and they produce a tougher image.

Driography

The 3M Company has recently introduced a new process for making plates called Driography. This system employs a flat-surfaced presensitized plate which has an ink-repellent coating and does not require water to keep the nonimage areas free from ink when the job is run on the press. This process will eventually be used with positives as well as negative-working plates.

An ultra-violet light source is used to expose the plate. The plate is exposed through a negative layout in the conventional manner. After this it is developed with a single step developer and then rinsed with water and dried. It can be developed by hand or in an automatic plate processing machine. (Plate processing machines will be discussed later in this chapter.) During development the coating is removed in the image area but remains on the plate in the nonworking areas. It is this background coating that allows the plate to be run without dampeners on the press. Care must be taken not to scratch the plate when it is being processed. The plate must be rinsed before the developer dries, or it may scum when it is placed on the press.

A specially formulated ink is used on the press for these plates. Before the plate is removed from the press, the ink should be completely removed from the image area by running waste sheets through the press without feeding ink to the rollers. It is not necessary to gum the plate at any time.

Direct-Image Plates

Direct-image plates or masters originally consisted of plastic-coated paper or an aluminum foil on a paper base. These plates were not light-sensitive, and the image was put on them by direct means, such as typing, drawing, ruling, and so on. Today, you can produce photographic images on these plates by the Xerox process, which was described earlier. Masters are also available with light-sensitive coatings, or you can sensitize the plates yourself by going over them with a special wipe-on coating solution when it is desirable to prepare all or parts of them photographically.

Instructions for preparation of direct-image masters are found in chapter 3.

Although they vary slightly, paper products with light- or heat-sensitive coatings, such as Electrofax and Thermofax, are also included in the paper plate category. Thermofax plates have a heat-sensitive coating and they are imaged by exposure to heat. Electrofax plates have a coating of zinc oxide which can be exposed and developed with a toning powder in the manner previously described.

DEEP-ETCH PLATES

Deep-etch plates are made of grained aluminum or stainless steel. The plate is coated with a solution of gum arabic and ammonium bichromate which must dry completely before the plate is exposed to light. The plates are exposed through a film positive. (See fig. 10-12.) Because a positive is used instead of a negative, the light hardens the coating in the non-image areas of the plate, rather than the image areas. After exposure, the plate is developed with a chemical solution which removes the unhardened coating that leaves the plate bare in the image areas.

The plate is then etched with an acid solution that eats slightly below the surface of the metal in the image areas, but does not affect the metal areas hardened by the light during exposure. Next, a lacquer is rubbed into the etched out areas to form a base for the image. After the lacquer is applied a special developer ink is spread on the plate to form the image. After this step the entire plate is soaked in water to dissolve the coating in the non-image areas. As soon as this coating is removed, the plate is etched and gummed to prevent oxidation.

Although the image of these plates is etched slightly below the surface of the metal, the etched area is so shallow that the plate carries ink above as well as below the plate surface. This enables deep-etch plates to produce a deeper, brighter image than conventional surface plates. These plates are also more durable than surface plates, often producing sharp impressions up to 500,000 per run.

Multimetal Plates

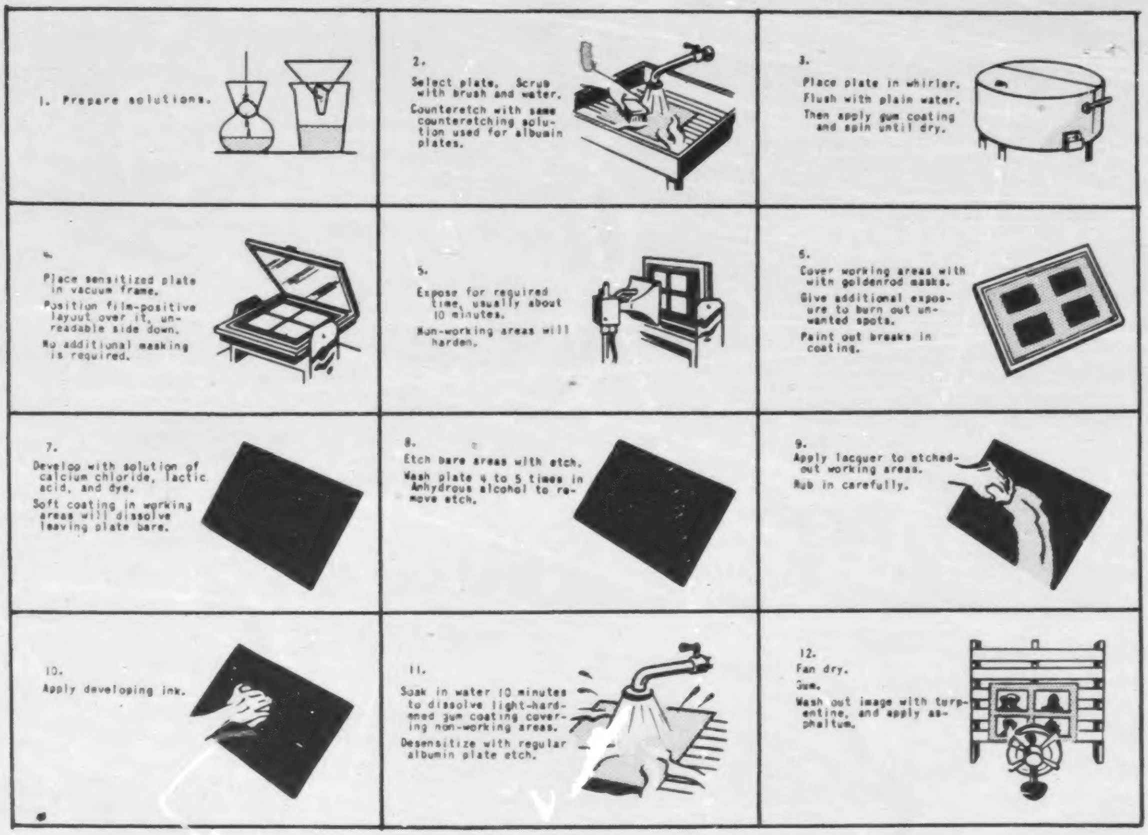
Multimetal (hard metal) plates are good for as many as 5 million impressions and can be developed in plate processing machines in approximately 30 minutes. These plates consist of two (or three) layers of metal. (See fig. 10-13.) One layer generally consists of copper, which is friendly to ink but not to water and the other layer may consist of aluminum, chromium, or stainless steel, which is water receptive but does not take ink. If a third layer is used, it is simply a base for the other two metals and may be either chromium, zinc, aluminum, or steel. (These plates are called bimetal if they consist of two layers of metal and trimetal if they consist of three layers.) Presensitized plates are available or the platemaker may coat the plate himself with a deep-etch coating and whirler.

If the top layer is copper, a negative layout is used in making the plate. (See fig. 10-13.) During the exposure, the light hardens the image areas. The unhardened coating is then removed from the nonprinting areas with the deep-etch developer. After this, the nonimage areas are etched with a solution that eats away the thin copper coating and leaves the second layer of metal exposed in these areas. The coating is then removed from the image areas and the copper image is treated with a weak acid solution to make it more receptive to the greasy ink. The image is then rubbed up with ink and the plates are finished in the same manner as deep-etch plates.

A slightly different procedure is followed if the top layer is aluminum, chromium, or stainless steel. (See fig. 10-13.) In this case, the plate is made from a film positive and the nonprinting areas are hardened during the exposure. After development with deep etch developer, the top layer of metal is etched away in the image areas to expose the bare copper underneath. The coating is then removed from the nonworking areas and the plate is processed, much the same as the regular deep-etch plate. Trimetal plates have an additional layer of chromium and are always positive-working.

RELIEF PLATES

This platemaking process is completely different from those discussed so far. It involves a metal or plastic plate that is slightly thicker than the conventional offset press plate. During proc-



1. Prepare solutions.

2.
Select plate. Scrub with brush and water.
Counteretch with same counteretching solution used for albumin plates.

3.
Place plate in whirler.
Flush with plain water.
Then apply gum coating and spin until dry.

4.
Place sensitized plate in vacuum frame.
Position film-positive layout over it, unreadable side down.
No additional masking is required.

5.
Expose for required time, usually about 10 minutes.
Non-working areas will harden.

6.
Cover working areas with with goldenrod masks.
Give additional exposure to burn out unwanted spots.
Paint out breaks in coating.

7.
Develop with solution of calcium chloride, lactic acid, and dye.
Soft coating in working areas will dissolve leaving plate bare.

8.
Etch bare areas with etch.
Wash plate 4 to 5 times in Anhydrous alcohol to remove etch.

9.
Apply lacquer to etched-out working areas.
Rub in carefully.

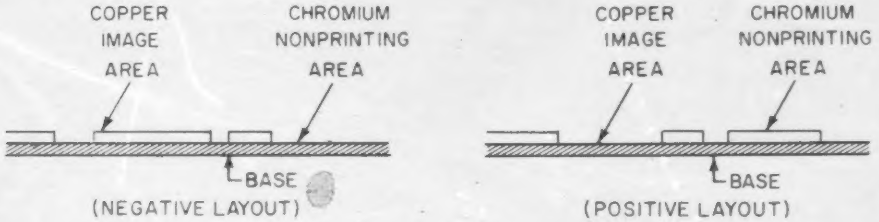
10.
Apply developing ink.

11.
Soak in water 10 minutes to dissolve light-hardened gum coating covering non-working areas.
Desensitize with regular albumin plate etch.

12.
Fan dry.
Gum.
Wash out image with turpentine, and apply asphaltum.

57.184

Figure 10-12.—Steps involved in making a deep-etch plate.

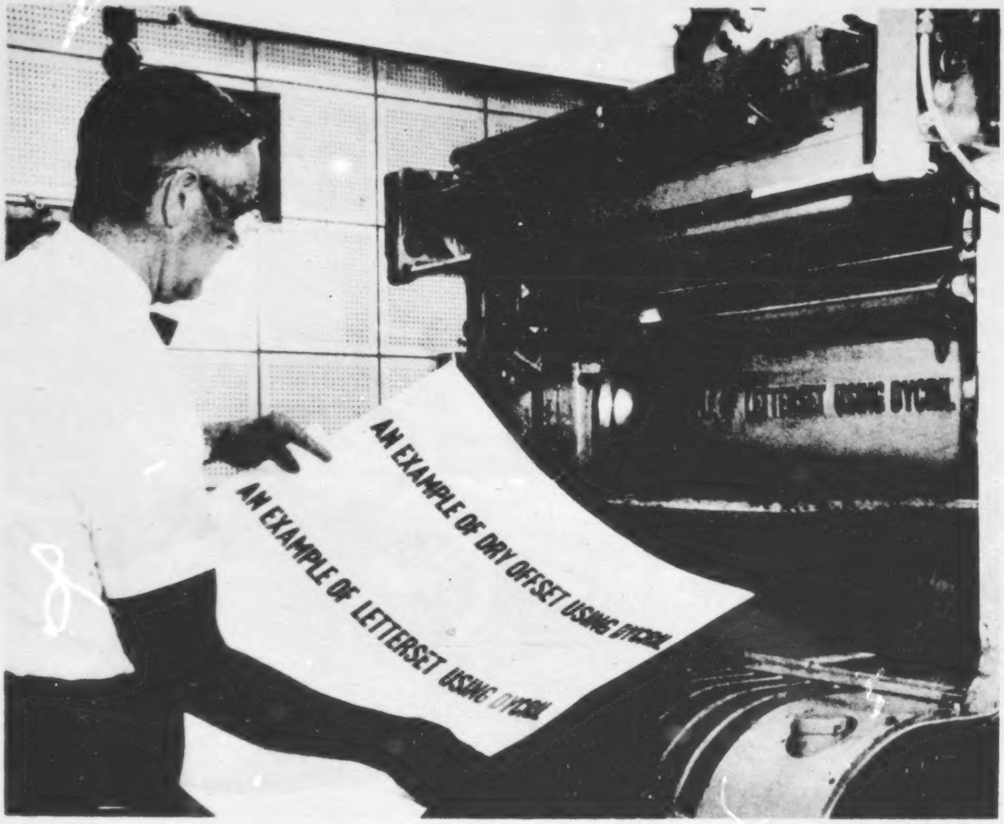


57.171

Figure 10-13.—The image on a multimetal plate may be in relief or it may be etched below the surface of the plate.

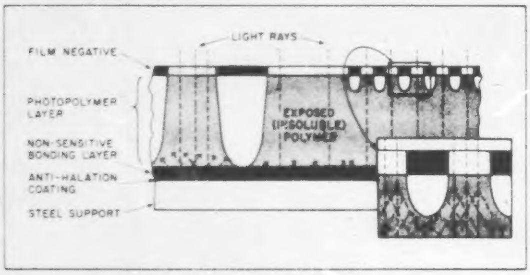
essing, the nonworking areas are etched away so that the image actually stands in relief. The water rollers are thrown out of operation when this type of plate is run on the press.

Dupont produces a plate known as the Dycril Photopolymer Printing Plate which is used for dry-offset printing. (See fig. 10-14.) As you can see in figure 10-15, this plate consists of a


AN EXAMPLE OF DRY OFFSET USING DYCRIL
AN EXAMPLE OF LETTERSET USING DYCRIL
LETTERSET USING DYCRIL

57.174X

Figure 10-14.—An impression produced from a Dycril printing plate.


LIGHT RAYS
FILM NEGATIVE
PHOTOPOLYMER LAYER
NON-SENSITIVE BONDING LAYER
ANTI-HALATION COATING
STEEL SUPPORT
EXPOSED (INSOLUBLE) POLYMER

57.175X

Figure 10-15.—Cross section of Dycril plate during exposure.

relatively thick layer of plastic bonded to a metal base. A negative is used in printing the plate and exposure is made to a strong arc or ultra-violet light. The plastic layer is hardened wherever it is struck by the light, but the protected areas are not affected and are later dissolved (etched away) by washing in a sodium hydroxide solution. Development takes about 6 minutes and the plate is then ready for the press. This plate can be used successfully for both letterpress and offset printing. When this thicker plate is used on some offset presses, it may be necessary to undercut the plate cylinder or adjust the bearers between the plate cylinder and the blanket cylinder. (The operator must either replace an undercut cylinder when he wishes to convert back to standard offset printing or he may be able to reserve one press for use only with the thicker Dycril plate.) The Dycril Type C plate is a relief plate that is thin enough to run on the ordinary offset press without special undercutting of the plate cylinder or major adjustment to the bearers.

The Eastman Kodak Company produces a relief plate consisting of a sheet of Kodalith film bonded to a metal base. The film is exposed to a negative and then developed in a special activator solution. After that it is washed and dried and then processed in a machine which removes the coating not hardened during the exposure. No dampener rollers are required when relief plates are run on the offset press and the printing done with these plates is often called "letterset."

In the last few years extensive research has gone into developing relief plates for use in letterpress printing. Most of these plates have a photopolymer coating on a steel or other metal base. Exposure is to ultra-violet light and special processing equipment is generally required. Development time is 30 minutes more or less depending on the type of plate. The thickness of the plate and depth of etch into the surface also varies. There are approximately 9 or 10 of these plates on the market and they are beginning to make inroads into letterpress printing where they are used instead of stenotypes.

PROCESSING PRESENSITIZED PLATES

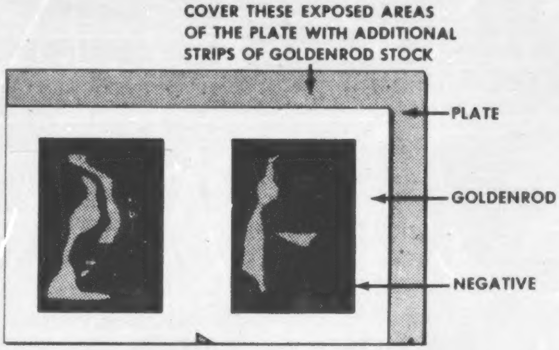
The discussion up to this point has been designed to give you a brief overall picture of the different types of plates and the processes involved in making them. The remainder of this chapter will cover in more detail the processes which you are most likely to come across in your work.

As you have already seen, presensitized plates are coated by the manufacturer and come to you ready for use. In contrast to conventional zinc or aluminum plates, which range in thickness from 0.012 to 0.030 of an inch, depending on their size, these plates are relatively thin, ranging from 0.005 to 0.012 of an inch in thickness. For this reason, you must handle them carefully to prevent buckles.

Since the coating on these plates is also more sensitive to light than that used on conventional plates, you should keep them away from strong light. When possible, they should be handled under yellow light. If yellow bulbs are not available, you may cover the regular bulbs with goldenrod paper. When you open a package of plates, be sure that they are carefully rewrapped to prevent accidental exposure on the shelf. Properly stored in a cool place these plates will keep from 6 to 12 months. The expiration date is generally marked on the package and you should use the plates on a "first in, first-out" basis so that the oldest plates will be used first.

Printing the Plate

When you are ready to expose or print the plate, you should place it face up in a vacuum frame and position the goldenrod flat over it with the emulsion side of the negatives in direct contact with the coating on the plate. Locate the work on the plate by accurately aligning the gripper edge of the flat to the plate and by using other reference marks provided on the flat by the stripper for positioning purposes. If any areas of the plate are not covered by the goldenrod paper, cover them with strips of goldenrod, as shown in figure 10-16.


COVER THESE EXPOSED AREAS OF THE PLATE WITH ADDITIONAL STRIPS OF GOLDENROD STOCK
PLATE
GOLDENROD
NEGATIVE

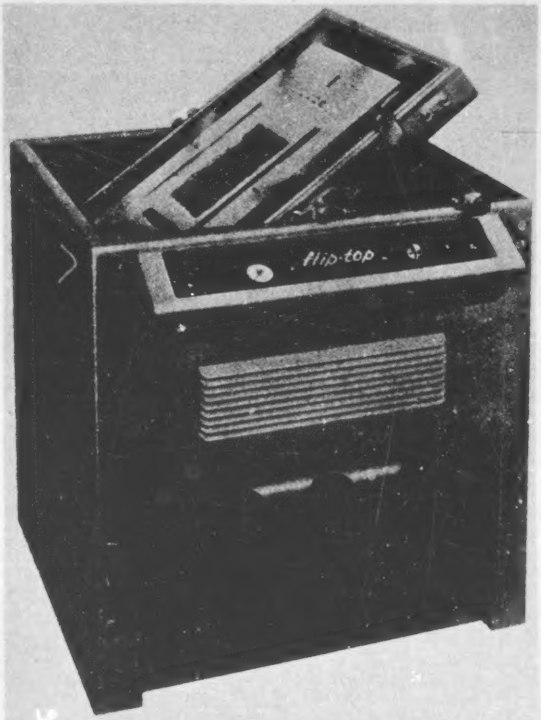
57.180

Figure 10-16.—The edge of the goldenrod layout is aligned with the edge of the plate along the gripper edge and on the left side. The wedge-shaped cuts identify the gripper edge of the layout and aid the platemaker in positioning the work. The goldenrod flat generally covers the entire plate. If it doesn't, use additional strips of goldenrod to cover the exposed areas of the plate, as shown here.

Many shops are equipped with a plate exposure unit similar to the one shown in fig. 10-17. These units are commonly called platemakers and feature a built-in light source which is located inside the cabinet beneath the vacuum frame. As you can see, the vacuum frame pivots to face the light source when you are exposing the plate.

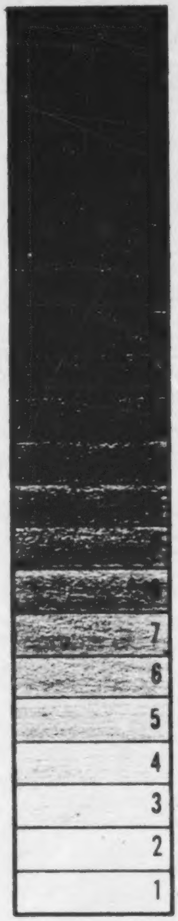
In case of doubt, it is better to overexpose slightly than to underexpose the plate. If you do not give it enough exposure, no image will be formed or the image will be so weak that it will not stand up on the press. If you give it too much exposure, fine lines or tone areas may fill in.

In some shops, a gray scale, like that shown in figure 10-18, is stripped into the flat along the gripper edge so that it will print on the plate but will not print on the paper when the job is run. The gray scale is a strip of continuous tone film with 21 graduations or density steps. These steps are numbered, as you can see in the illustration, and each step is slightly more dense than the step before it. When the plate is exposed, the coating will be underexposed at one end of the scale and overexposed at the other. When the platemaker develops the plate, he will generally find that the first four to six steps will be solid,



57.737X

Figure 10-17.—A self-contained flip-top platemaker. The unit contains a vacuum system, vacuum frame, and exposure source.



57.183B

Figure 10-18.—An artist's conception of a 21-step sensitivity guide used to determine correct plate exposure. Variations of platemaking sensitivity guides are available from manufacturers of plates and platemaking equipment and supplies.

the next three or four steps will show as gray areas and the remainder of the steps will wash off completely.

If step 4 is the highest completely solid step, the plate is just slightly underexposed; if step 5 is the highest step, the exposure is just about right. If more than 7 steps go solid, the chances are that the plate is overexposed. If the press run is short or if you are working with half-tones, you may find it better to expose for a solid four, but for other kinds of work, you should expose for steps five or six. In extreme cases, you may expose for a solid seven when the image consists of line work and a long press run is required.

If the plate is underexposed, you can increase your gray scale reading by one step by increasing the exposure 50 percent; you can increase it two steps by doubling the exposure; and you can increase it three steps by tripling the original exposure. Conversely, if the plate is overexposed, you can reduce your gray scale reading by three steps by dividing your original exposure time by 3; you can reduce the reading 2 steps by dividing the exposure by 2 and you can reduce it one step by dividing the exposure by 1 1/2.

Developing

After the exposure is completed, remove the plate from the vacuum frame and place it on a table. Then go over it with the proper chemicals, following the instructions furnished by the manufacturer. Processing will vary from one type of plate to another, but you will generally find a set of processing directions in each package of plates.

If the plate is coated on both sides, always place a piece of paper under it before you begin developing it, and change the paper before you start processing another plate. This will protect the second side from chemicals that might seep under it during processing. If you have trouble with chemicals seeping under the plate during this operation, you may find it necessary to print both sides of the plate before you process it. You can then develop one side of the plate and turn it over and develop the other in one continuous operation.

In most cases, the exposed plate is first treated (developed) with a solution that dissolves the unexposed coating or makes it water-receptive.

Once this solution has been applied, you can put the plate on the press and run it just as it is. However, if the plate is to be held for some time, or if it is to be used for a reasonably long run, it is best to cover the image with a thin coating of lacquer. The lacquer supplies color to the image so that you can check it for defects and it also lengthens the life of the plate by forming a tough, protective coating over the image areas. Do not use too much lacquer. A thin coating will outlast a thicker one when the plate is run on the press.

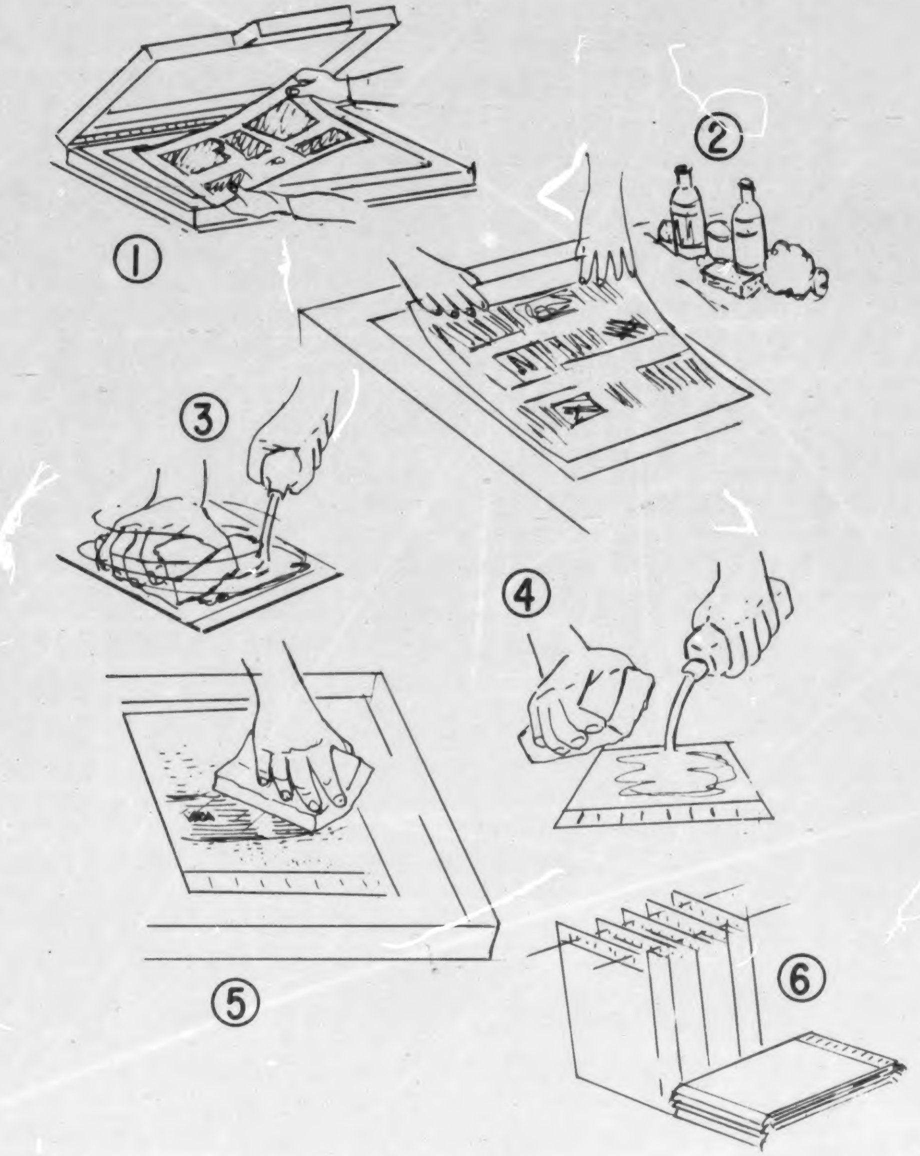
In addition to applying the lacquer, most operators also gum the plate with a solution of gum arabic to protect it from fingerprints and scratches during makeready operations.

If the plate is not to be used for 2 or 3 days, some platemakers also cover the image with asphaltum.

Processing a Presensitized Plate

Although procedures vary according to the type of plate you are using, the following steps are typical of those used in processing a presensitized aluminum plate. (Figure 10-19 illustrates the process.)

1. Remove the plate from the package, but do not leave it exposed to light for an extended period. Keep the plate covered if the flat isn't readily available.
2. Position the flat over the plate in the vacuum frame with the readable side of the negatives facing you. Close the frame, turn on the vacuum, set the timer, and turn on the light source to expose the plate.
3. When the exposure is completed, remove the plate and flat from the vacuum frame and place the plate on a clean, flat surface.
4. Apply the desensitizing solution to the plate with a sponge or pad, using a firm circular motion, to remove the unexposed diazo coating. Wipe off any excess desensitizer, but keep the plate surface moist.
5. Pour a pool of developer solution into the center of the plate: distribute it evenly with a clean pad or sponge over the entire plate, using a



57.738

Figure 10-19.—Steps involved in imaging a presensitized plate.

firm circular motion. Continue developing the plate until the image appears uniform.

6. Wipe off any excess developer and carefully inspect the plate. Rinse the plate with water.

7. If the plate isn't going to be used immediately, protect the plate from oxidation and scratches by coating it with gum. Once the gum is dry, the plate may be stored by hanging it or by stacking it flat with paper slipsheets.

Processing a Positive-working Plate

As you know, presensitized plates are available for use with positives as well as negatives. The chances are that you will work chiefly with negatives. However, positive plates are sometimes printed directly from ozalid transparencies, tracings, form letters or proofs pulled from type on acetate, and so on.

If you have occasion to use positive-working plates, you should follow the processing directions supplied by the manufacturer.

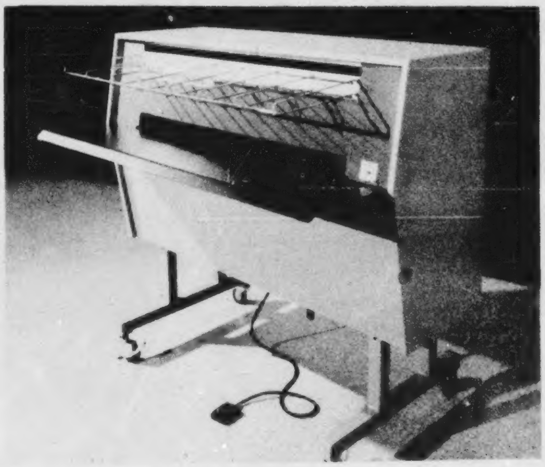
Some positive- and negative-working presensitized paper plates can be developed with a sponge soaked in plain water. These plates are good for short runs and are useful when speed is a factor.

Subtractive Plates

The 3M Company has developed a line of presensitized, prelacquered plates which are known as subtractive plates. The lacquer is applied over the entire face of the plate by the manufacturer. During development the lacquer is removed (subtracted) from the nonprinting areas instead of being added to the image.

A single processing solution is used and the same solution can be used for both the long run "S" and the medium run "K" plates put out by the 3M Company. After processing, the plate is washed in plain water to remove the chemical and is then ready for gumming or for putting on the press.

The 3M Company has also developed a machine, known as the MR-440 which can be used to develop the plates automatically. (See fig. 10-20.) The operator simply feeds the plate into a slot in the machine and steps on a foot switch to start the machine operating. As the plate is drawn through the machine, developer is sprayed on the plate and rotary brushes clean away the coating in the nonimage areas. The plate is ejected at the top of the machine in 40 seconds and the machine turns off automatically, ready for the next plate. The operator removes the plate and rinses it in cold water. After this he squeegees the water off, and the plate is ready for the press, or if it is to be stored for later use, he gums it in the normal manner.



57.631X

Figure 10-20.—The 3M Company's Plate Developing Machine, MR-440.

In addition to providing even development over the entire plate, plate processors are faster than developing a plate by hand. They are also more economical because the processing solutions can be recycled and used again. How long the plate developer lasts depends on the size of the areas from which the coating is removed. The operator sometimes adds a replenisher solution to the developer to prolong its life. Normally, the developer is changed every two weeks and the machine is given a 30-minute clean-up.

Most plate processors will accept plates of various sizes and thicknesses without requiring special adjustments. However, a single processor cannot be used for all types of plates, because as a rule the processing solutions are not interchangeable from one type of plate to another.

Until recently plate processors were used entirely to process presensitized plates but there are now processors in use for certain types of multimetal plates. Experiments are underway to develop a machine that can be used for deep-etch and other positive-working plates.

3M Camera-Processor

The 3M Camera-Processor, shown in figure 10-21, is an automatic camera and processing unit combined into one machine. It photographs reproduction copy and produces a ready-to-run plate bearing a positive image in less than 1 minute. It can reduce copy as much as 45 percent and make up to 150 percent enlargements. It can copy line work and previously-screened halftone clippings provided the screen used for the clippings was not finer than 110 lines per inch. The plates produced on this machine are good for 1,000 to 5,000 impressions, and they can be stored and used again.

The plate material consists of a polyester base with a layer of silicone and a light-sensitive, silver-halide coating. It is relatively stable and will not stretch or tear. It comes in a 250-foot roll which is loaded into a magazine at the back of the camera. The material is automatically wound down off the roll and cut to plate length as each exposure is made. No film is used in making the exposure. The exposure is made on the plate itself, and a positive image is produced from positive copy. After the plate has been exposed and cut, it is caught by a series of rollers which carry it through the processing solutions and finally eject it through a slot at the back of the machine.

Two processing solutions and two water baths are used. The plate first travels through a tank of developing solution where it turns black all over. It then passes into a water bath which removes the silver halide particles in the unexposed areas leaving only the blackened image on the plate. From there it goes into an activator solution which causes the unprotected nonimage areas to become water-receptive. The activator solution also removes the silver image from the plate, but does not have enough time to act on the image area to make it water receptive. The plate next travels into a tank of clear water for the final rinse. After this, it passes between heated rollers which squeegee off the water and evaporate any remaining moisture. It emerges from the machine dry and ready for use.

This machine will take copy as large as 24″ X 36″, and it can produce plates from 9″ to 24″ long in widths of 9″, 10″, 11″ and 12″, depending on the width of the roll of plate material used in the camera. Since it tends to hug the plate cylinder, the tail end of the plate may be run loose on the press. This means that you can run a shorter than usual plate when the image area is small. You can run a 10″ X 11″ plate on a 10″ X 15″ press, for example.

As you can see in figure 10-21, this machine consists essentially of a camera unit and a processor. The camera unit consists of the copyboard, the lamps, the camera, and the magazine which holds the film. The processing unit houses the processing tanks and solutions.

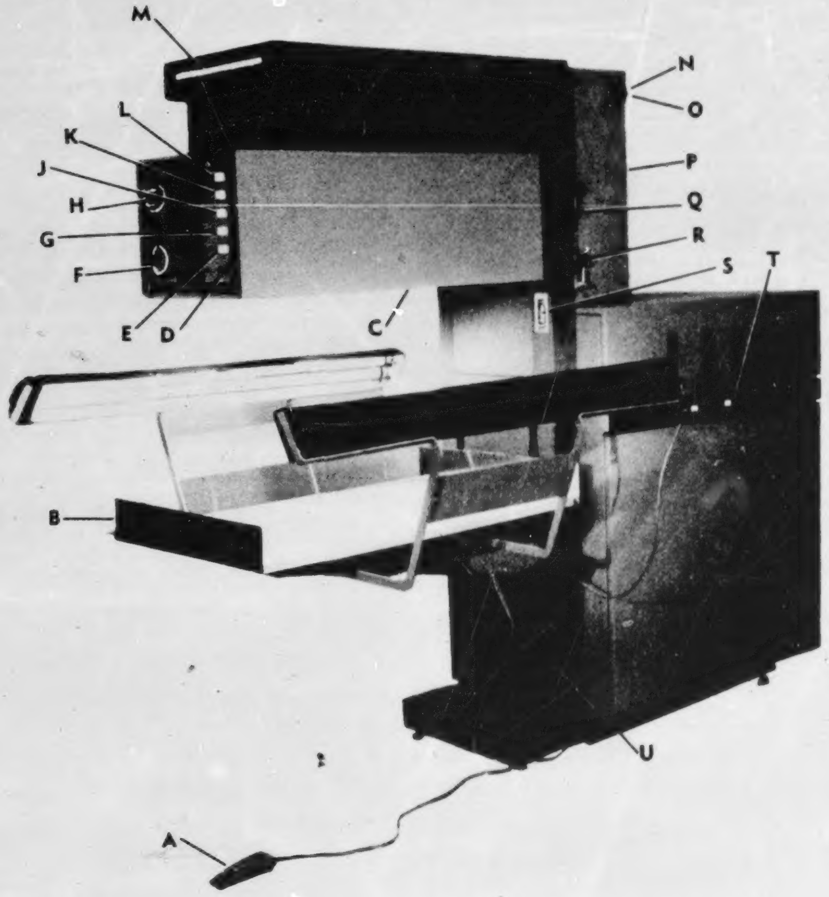
The camera has a movable lensboard which is connected to the magazine by an extension bellows. You will notice in figure 10-22 that the lens is positioned at a right angle to the copyboard. A prism is used to bend the image 90 degrees and to reverse it so that it will read forward instead of backwards on the plate. The lens is equipped with a diaphragm with aperture settings ranging from f/10 through f/90. It also has a shutter which is opened and closed automatically during the platemaking cycle. You can control the length of time the shutter stays open by setting the timer on the control panel.

Operating Controls

Most of the operating controls are located on the right side of the machine or on the control panel at the front of the machine. (See fig. 10-21.) The dial (H) shown in figure 10-21 is used in setting the machine for the desired plate length. You can set it for any length from 10″ to 24″. You can also set the machine for 9″ plates by moving the pointer slightly beyond the 10″ mark. When you set the length of the plate on dial (H), you must also use the crank (N) to move a curtain up or down inside the magazine. (The curtain, as you will see later, masks off all of the plate material except the area to be exposed.) The curtain should be set 5/8″ longer than the length you have set on the plate length dial. An indicator at the back of the magazine shows the setting of the curtain.

The dial (F) is for setting the exposure time. You can set it for any exposure from 1 to 30 seconds by rotating the black knob.

The switch (L) operates the splice detector. When the detector is on, a buzzer sounds to notify you when the magazine is empty or when the area of the plate material to be exposed has a splice in it. There are normally no splices in a 250-foot roll of plate material. However, extra



A. Foot switch. Starts automatic platemaking cycle.
B. Reflector.
C. Lens (hidden). Open hinged side panel to reach lens.
D. Counter.
E. Copyboard position switch for raising and lowering copyboard.
F. Timer. Set to control length of exposure.
G. Lens position switch. Use for moving lensboard.
H. Plate length dial. Set pointer at number on dial which corresponds to the length in inches desired for finished plate.
J. Camera power switch for turning on power to lights and camera.
K. Multiple exposure switch. Leave in off position for normal run of work.
L. Splice detector switch.
M. Lensboard indicator scale.
N. Crank for raising and lowering curtain.
O. Curtain indicator (hidden). The number in this window indicates the position of the curtain in inches. Set curtain 5/8" longer than the number set on plate length dial (H).
P. Magazine.
Q. Magazine latch.
R. Roller pressure lever.
S. Copyboard indicator scale.
T. Drive switch.
U. Copyboard.

57.632X

Figure 10-21.—The 3M Camera-Processor.

material is included in each roll to allow for splices in case one happens to occur. Do not make a plate on a spliced area; run it on through the machine as waste.

The multiple exposure switch (K) is used when you are making multiple exposures. You should keep it turned off except when you desire to make more than one exposure on the same plate.

The lens position switch (G) is used for moving the lensboard in and out for focusing, and the copyboard position switch (E) is for raising and lowering the copyboard. The lensboard position indicator (M) and the copyboard position indicator (S) show the positions of the copyboard and lensboard. The settings should be the same on both of these indicators for proper focusing. The plate counter (D) records the number of completed platemaking cycles. There is another counter inside the small door at the back of the magazine. You should set this counter at zero when you load a new roll of plate material into the machine. You can check it thereafter to determine when the roll is running low.

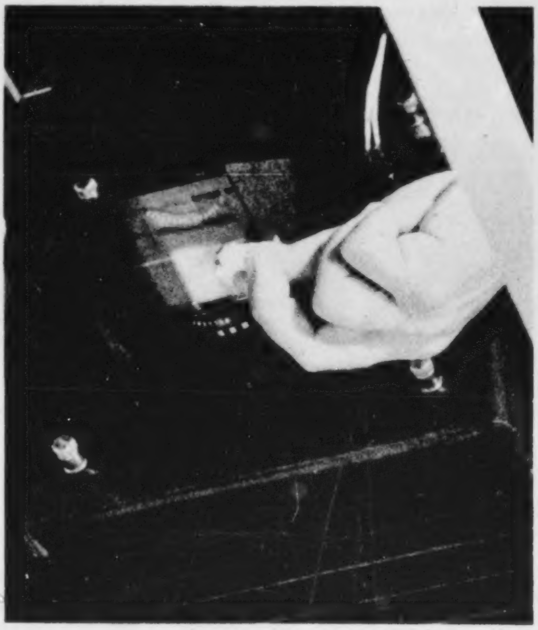
The camera power switch (J) shown in figure 10-21 supplies the power to the lights and camera section of the machine.

The foot switch (A) is used to start the platemaking cycle. When you step on it, the automatic plate system takes over and delivers you a press-ready plate.

The developer-ready light (A) shown in figure 10-23 comes on when the developer has reached the proper temperature. The switch (C) is for turning on the heaters, and the drive switch (E) is for turning on the power for the processor rollers. The indicator lights to the left of the switches come on when the drive and heater switches are turned on. It takes a few minutes for the processing solutions to reach the proper temperature at the beginning of the day. You should keep the heater on at all times during the day, but you can turn off the drive switch when you are not actually processing plates.

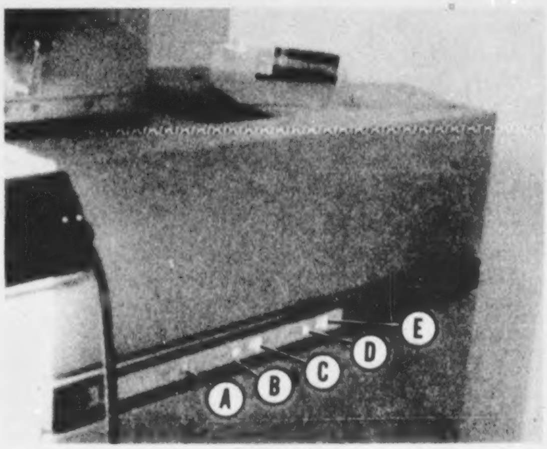
Copyboard

The horizontal copyboard has a glass cover which is opened from the front. The bed of the copyboard is white and it is provided with a



57.633X

Figure 10-22.—The lens.



A. Developer ready light comes on when developer reaches operating temperature.
B. Indicator light.
C. Heater switch.
D. Indicator light.
E. Drive switch.

57.634

Figure 10-23.—Heater and drive switches.

series of blue reference lines in the form of rectangles. These rectanges are marked according to the amount of reduction or enlargement required and you can use them as an aid in positioning your copy and determining the settings for your copyboard and lensboard.

If your copy is to be reduced 45 percent, you should position it in the rectangle marked "45". If it is to be enlarged to 150 percent, you should place it in the rectangle marked "150", and if it is to be shot same size, you should place it in the rectangle marked "100". Position the copy against the top line of the rectangle and center it from side to side within the area.

As a rule the reference lines will not photograph. However, they may show up if the plate is underexposed.

Focusing

Proper focusing depends not only on the placement of the copy in the proper rectangle on the copyboard, but also on the position of the lensboard and copyboard. If the copy is to be reduced 45 percent, for example, you should place it in the rectangle marked "45" on the copyboard and you should then move the copyboard and lensboard until they both register 45 percent on the focusing indicators.

You can raise or lower the copyboard with the switch (E) shown in figure 10-21. The indicator (S) shows the amount of enlargement or reduction. If the copy is to be reproduced same-size, move the copyboard until the indicator is at the 100 percent mark. If the copy is to be reduced 45 percent, move the copyboard until the indicator is at the "45" mark, and so on.

You should use switch (G) shown in figure 10-21 to set the lensboard at the same percentage as the copyboard. As you can see in the illustration, the lens position indicator (M) is located just above the control panel at the front of the camera.

Focusing Thick Originals

Books or other thick originals may prevent you from closing the cover of the copyboard. In this case, you should place the original on top of the cover and then place a piece of glass over the original to keep it from curling. If the edges of the copy cast a shadow, overexpose these areas to eliminate the shadows.

If the thickness of the original causes the image to be out of focus, you should lower the copyboard so that the original will be at the height the copy would normally be for proper focus. If focusing is still a problem, you can open the back of the camera and focus visually on a ground glass. (The ground glass supplied with each machine can be inserted into the machine if it is needed. It is generally used only for lining up the focusing scales when the machine is first installed; however, it can be used for focusing in cases like the one just mentioned. If should be removed from the camera at all other times, of course.)

To use the ground glass, roll the curtain all the way down. Then open the magazine and place the ground glass frame over the locating pins and snap them into place on the bellows rack. Set the lens aperture at f/10 and set the exposure dial to 30 seconds. Press the multiple exposure switch (K) shown in figure 10-21 to its "on" position. Then depress the foot switch and an image will appear on the ground glass for 30 seconds. Step on the foot switch again, if necessary, so that you can see the image as you bring the camera into focus. You can focus the image by moving the lensboard or copyboard slightly. Do not raise the copyboard above the 100 percent magnification position, however. The lamps may be damaged if the copyboard is raised too high when the magazine is open. Use a linen tester or magnifier to examine the image on the ground glass, and dim the room lights, if necessary, to help you see more clearly.

Camera Lamps

There are two camera lamps which travel along with the copyboard. Each lamp has two prefocused bulbs. Diffusing grids are provided at the center of each lamp assembly. Reflectors are also provided at the ends of the copyboard to help balance the lighting.

It is not necessary to adjust the lights except when you are photographing large copy. In this case, you can move them out to provide more even illumination. The lamp frames are notched to lock in the proper "in" and "out" positions.

The bulbs will burn for approximately 2,400 hours. However, they lose intensity as they are used, and it is necessary to compensate for this by increasing the exposure slightly. When you reach the point that excessive exposure time is required, you should change all the bulbs at once. Before removing the bulbs, notice how they are positioned in the lamps so that you can get the new ones back in the proper positions. (The lower bulbs have a clear window which should be facing the copyboard and the upper bulbs have an opaque back which should be away from the copyboard toward the reflector.) There is a retractable lamp socket at one end of the bulbs to facilitate removing and replacing them.

You have already seen how to turn the lamps off and on with the switch (J) shown in figure 10-21.

Making the Exposure

A 10- to 20-second exposure at f/32 is generally used for black-and-white copy of good contrast, such as typed, printed, or written material. You may need to increase the exposure, however, to drop gray or blue from the background; drop or reduce shadow lines; expose through an acetate overlay, zipatone, or filters; sharpen prescreened halftones; expose smudged copy; or to enlarge the original copy 150 percent.

You can decrease the exposure time to copy a light blue or gray image; hold or broaden thin lines; or reduce the original 45 percent.

Some cameramen photograph a 12-step gray scale along with the original copy, positioning it so that it will print on the tail edge of the plate but not on the paper. If you use a gray scale, you should shoot for an open step 3 or 4 for normal copy. If the background of the copy is dark, it may be necessary for you to increase your exposure in order to get a satisfactory image. And if the image on the copy is very light, it may be necessary for you to reduce your exposure and drop down to an open step 2 on the gray scale. In this case, you should notify the pressman, because such a plate may not stand up well on the press.

Multiple Exposures

You can expose two separate pieces of copy on the plate at the same time if the exposure requirements are the same for both pieces. If they are not, you must use multiple exposures for this type of copy. If multiple exposures are required, you should turn on the multiple exposure switch (K) shown in figure 10-21. This will prevent the plate from advancing until after you have completed as many as three separate exposures on it.

Use black paper to mask out all the copy except the area that is to be exposed, and shift your masking, as necessary, until all exposures have been made. Then turn off the multiple exposure switch to advance the plate through the machine.

Filters

No provision is made for mounting a filter over the lens; however, you can place a 2-mil polyester filter sheet over the original copy (under the copyboard glass) and photograph the copy through it. A yellow filter sheet will often improve, gray, weak or aged copy.

Magazine

As you can see in figure 10-21, the magazine which holds the roll of platemaking material is located at the back of the camera. You can release the latch (Q), shown in figure 10-21 and open the magazine when you are changing rolls or focusing visually on the ground glass. Check to see that the copyboard is not raised above 100 percent magnification before swinging the magazine door open; you may damage the lamps if you open the door when the copyboard is too high.

The magazine is equipped with rubber rollers for winding down the plate material and with a mechanism which cuts the roll to the selected plate length after each exposure. As you have already seen, the width of the plate depends on the width of the roll, but you can control the length of the plate by setting the dial (H) shown in figure 10-21 to the number that corresponds to the desired length.

The plate material comes (wound emulsion side out) in 250-foot rolls. These rolls are available in widths of 9, 10, 11, and 12 inches. The spool holders in the magazine are adjustable sidewise to accommodate rolls of different widths.

The magazine is also equipped with a curtain which has already been mentioned. This curtain is used to protect the plate from room light when the magazine is opened or to mask off a portion of the roll so that no exposure will be made except in the area designated for the plate. The crank (N) shown in figure 10-21 is used for raising and lowering this curtain. The indicator (O) shows the position of the curtain in inches at all times.

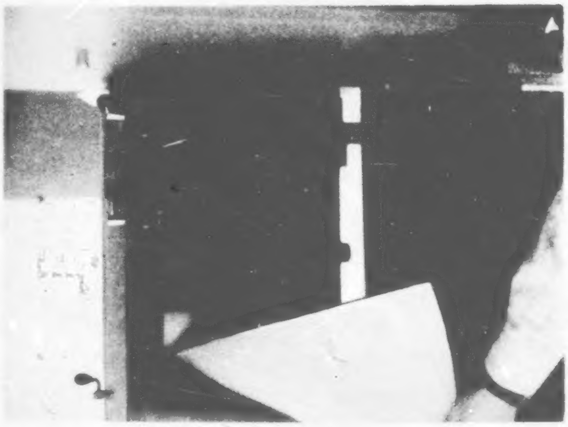
To keep from exposing the plate material, you should lower the curtain by turning the crank clockwise as far as it will go before you open the magazine. You should raise the curtain by turning the crank in the opposite direction when you are loading a new roll into the camera. You have seen earlier in this chapter how to set the curtain for the length of the plate during normal platemaking operations.

Mounting a New Roll in the Machine

To mount a new roll, you should turn off the splice detector switch on the control panel. Then release the roller pressure on the plate material with the crank (R) shown in figure 10-21. Next, unlatch the magazine and open the magazine door. Push the hinged retaining flap back to remove the old roll. If the old roll contains unused film, place it in the light proof bag from which the new roll was taken. This will prevent it from being damaged by exposure to light.

A black paper leader is spliced to the beginning of each new roll for use in threading the roll down into the machine. Place the new roll in the magazine with the leader feeding downward from the top of the roll, as shown in figure 10-24. Insert the roll so that it will unwind with the coated side facing the camera lens.

Center the roll in the magazine with the end caps of the roll resting on the carrier rollers. Set the guides to provide a slight tension (without binding) as the plate material is wound down from the roll. Insufficient pressure will result in sounding of the splice detector and improper tracking of the plate material across the focal plane.



57.635

Figure 10-24.—Unwinding plate material from the spool in the magazine.

Hold the end of the leader and close the magazine door. Then pull the leader down over the front of the magazine and thread it through the feed rollers and past the cutting knife. Close the curtain. Then grasp the edge of the leader below the magazine and pull it straight out, until you can see the splice where the plate material starts and the leader ends. Make certain the plate material is centered; then engage the feed rollers by moving the pressure lever (R) shown in figure 10-21 to the "on" position.

Next, go around to the front of the camera and set the plate length dial (H) shown in figure 10-21 to 10 inches. Set the exposure dial at 4 seconds and turn the camera power switch on. Press the foot switch and the camera will cycle, exposing and cutting off the leader and a few inches of the plate material. Once this cycle is completed, turn the plate length indicator to the length of plates you normally use and turn on the splice detector switch. Finally swing the magazine back into position and lock it in place. The camera is now ready for operation.

Processing Unit

The processor consists basically of four units or stages. It requires no plumbing and operates on 110-volt current. It is specifically designed to work with the 3M camera; however, it can be operated independently as a processor for other camera units, such as the Itek Platemaster.

After the exposed plate is cut to the proper length, it is automatically fed into the processor where gear-driven rollers move it into a tank containing 3M Camera Plate Developer, which should be kept heated to 80° F. After the plate leaves the developer, it passes into a rinse tank where water heated to 110° F is sprayed onto it by nozzles contained in the tank.

From there it passes into another tank containing 3M Camera Plate Activator (at room temperature); and from there it is carried into a tank of plain water (at room temperature) after the final rinse.

After leaving the final rinse tank, the plate passes through heated rubber rollers which remove excess water and evaporate any remaining moisture. The plate is then ejected from the machine into a tray, dry and ready for the press. You can use it just as it comes from the machine, or you can go over it with a wipe moistened with 3M Camera Plate Starter Solution and put it on the press while it is still wet with this solution.

Inspecting the Plate

When the plate emerges from the machine, you should check it by holding it at an angle to the light. If the fine lines in the image are too heavy, make a new plate, using more exposure. If the lines are too thin and the plate looks washed out, make a new plate using less exposure.

If you prefer, you can moisten the plate with 3M Camera Plate Starter Solution before inspecting it. This solution will make the inspection somewhat easier.

The back of the plate should be wet with water before it is put on the press. The water makes it hug the plate cylinder. This is particularly important when only one end of the plate is fastened to the cylinder.

Punching the Plate

The plates produced on this machine have straight edges. However, a punch is available for use in punching holes along the gripper and tail edges of plates that are to be mounted on presses having pinbar plate clamps.

You will get better results if you punch two or three plates at a time. This will cause the holes to be cleaner and will also cause the punch to last longer.

Making Deletions

You can make deletions to the plate after it is put on the press by raising the ink rollers and allowing the press to run with the water rollers on until all the ink has run off the image. Then stop the press and dry the plate. Remove any remaining ink from the area to be deleted with fountain solution. After this, apply 3M Camera Plate Deletion Fluid to the area to be deleted. Dry the area and go over it with fountain solution. If you accidentally apply the deletion fluid to the wrong area, rub the area lightly with press wash to correct the error.

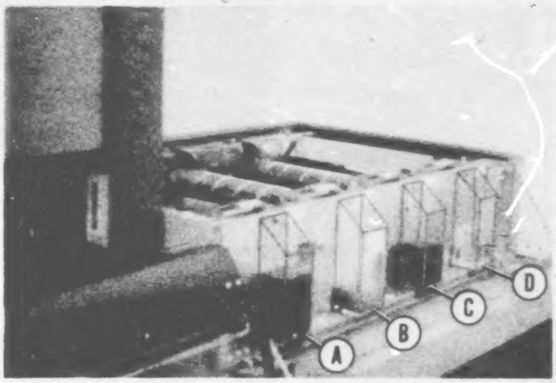
If a deleted area picks up the ink when you start the press again, the chances are that you did not allow the deletion to dry thoroughly or you may have failed to wet the area with fountain solution after drying it. Repeat the process to clean it up.

Filling the Processor Tanks

You can reach the drains and filler openings to the four tanks by opening the side covers of the processor. (See fig. 10-25.) Be sure all the drain valves are closed before you attempt to fill any of the tanks. If the tanks have been standing empty for a time, flush them with clean water to get rid of dried residue before filling them.

Make sure that the rollers are intact in all four tanks before you fill the first tank. Then pour enough developer into this tank to fill it to a point midway between the two red lines on the plastic spout (A) shown in figure 10-25.

Pour warm water into the filling spout of the second tank until it reaches the proper level between the two red lines on the spout. Then pour activator and water into the spouts of the other tanks until they reach the proper level.



A. Spout for developer tank.
B. Spout for wash tank.
C. Spout for activator tank.
D. Spout for wash tank.

57.637

Figure 10-25.—Feeder spouts leading to the developer, activator, and wash tanks.

Daily Maintenance Operations

At the beginning of each day, set the copyboard for less than 100 percent magnification. Then roll the curtain all the way down and open the magazine. Be sure the drive switch (E) shown in figure 10-23 is off.

You can then open the side panel and lift the top away to expose all the working parts of the processor necessary to daily maintenance operations.

Open the drain valve and drain out one quart of developer. Replace it with a quart of fresh developer. You can drain the developer into a 5-gallon container or you can drain it directly into a floor drain. Always flush the materials drained from any of the four tanks down the drain with plenty of water, since they tend to corrode the plumbing. If the solutions bother your hands, you should wear rubber gloves when working with them.

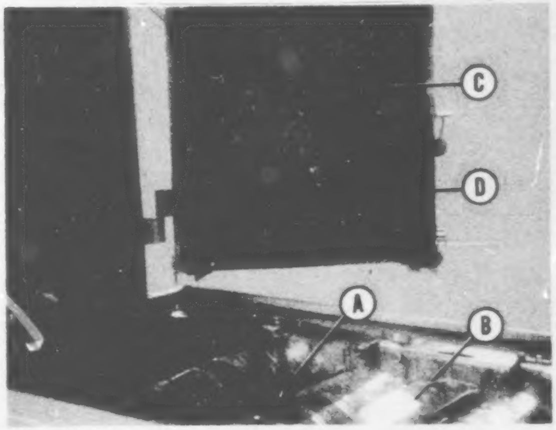
Next remove the carry-over plates that direct the plate material from one tank to another. (See fig. 10-26.) This will expose the entrance and exit rollers in each of the four units. Clean these rollers with a lint-free cloth. Jog the processor drive switch off and on intermittently to move the rollers around for cleaning. After cleaning, replace the carryover plates.

You should add at least one quart of developer at the beginning of each day. You have already seen how to do this. You should also check the levels of the solutions in the other tanks. If they are not up to the proper levels, add water to bring them up.

Finally replace the covers and close the magazine. The processor is now ready for operation.

Periodic Maintenance

The processing solutions become exhausted with age as well as use. Therefore, you should drain the developer and rinse tanks at the end of every two weeks or after 1,000 plates have been processed, whichever comes first. The activator solution lasts longer than the developer, but it should be changed every 6 months or after each 15,000 plates have been processed.



A. Transport station roller.
B. Carry-over plate.
C. Curtain.
D. Magazine (in open position with curtain rolled down to prevent exposure of plate material.)

57.636

Figure 10-26.—Processing unit with top casing removed.

Flush the tanks; then fill them with warm water. Turn on the drive switch and allow the rollers to run for a couple of minutes. Then turn the drive switch off again. Remove and clean the carry-over plates. Next remove the rollers comprising the transport stations by disengaging the twist clips that hold the units in place. Lift them out and wipe them clean in a sink. Do not use abrasives, scouring powder or detergents on them. A nylon scouring pad will provide sufficient scouring.

After this, drain the warm water from the tanks and flush them with warm water until all residue is washed away. Scour with a nylon pad if necessary.

Next, replace the transport stations, being careful to get each one in its proper place. Once this has been done, you can snap the carry-over plates back into position.

Finally refill all tanks to the proper levels. You have just seen that the activator tank does not require draining and cleaning except after every 15,000 plates. In the meantime, however, you can recharge the activator with the occasional addition of water to bring it up to the proper level.

You should check all solutions frequently. If the water in the first rinse tank becomes dirty, it may foam and interfere with the spraying action. If this happens, you should replace the wash immediately. You may be able to use 3M Anti-Foam to neutralize the foam if it is caused by a high hourly volume of platemaking. The final wash should be changed if it becomes yellow or full of sediment. Do not use Anti-Foam in this tank.

Securing the Processor

At the end of the day, you should shut off all power to the processor and you should shut off the heaters to prevent premature exhaustion of the developer. Drop the magazine curtain to prevent exposure of the plate material and open the magazine to keep moisture from forming inside the camera. (You should open the magazine any time the processor is unplugged.)

Drain the tanks if the processor is to be idle for a week or more. Then clean them completely and fill them with water.

General Maintenance

You should go over the copyboard glass and bed at regular intervals with a soft rag and a mild soap. Dirt and scratches on the copyboard glass will cause shadows which will photograph with the copy. Do not rub the bed of the copyboard excessively as this may remove the blue guide lines.

Check the lens assembly at regular intervals. If it is necessary to clean the prism, use a camel's hair brush or wipe it gently with lens paper. If a more thorough cleaning is required use lens cleaning solution and a soft cloth. Be careful not to scratch the surface of the prism or disturb its setting.

Once every 6 weeks, you should use No. 20 SAE oil to lubricate the copyboard and cover glass pivot and slides, drive screw, slide and slide rollers; the lens assembly rail and drive screw; the magazine motor, rack, knife, slide, pivot, advance shaft bearings, and clutch activating mechanism; and the processor motor, chain, chain rider sprocket bearings, and the chain back-up blocks.

PLATE TROUBLES WITH THE 3M CAMERA-PROCESSOR

Problem	Possible Cause
Spots on Plate	Copyboard or lens assembly may be dirty; rinse tanks may not be clean; or plate may have been ejected from the machine before it was thoroughly dry.
Blind plate	If no image appears, the plate may have been prematurely exposed before it was placed in the camera or there may be light leaks in the camera. Artificial light or sunlight reflecting from the copyboard glass into the lens can also cause overexposure.
Scumming	If the plate is dark or scummed all over, you may have underexposed it or there may have been insufficient contrast between the background and image on the original. Always check the magazine curtain to be sure it is not cranked down beyond the area you wish to expose.
Crooked image	If the image is crooked, the roll pressure may be incorrect in the magazine. Check also to see if the plate spool is loose, especially if the problem has been accompanied by intermittent buzzing of the splice detector. Check position of copy.
Plate breaks down	If the plate breaks down during the application of the starter solution, the exposure may have been too short or the developer worn out. You may also have rubbed too hard with the etching pad or the pad may be dirty or contaminated.
Blurred image	The copyboard glass or lens assembly may be dirty or the copy may have been out of focus.

The Itek Platemaster is a camera-processor which operates on the same principle as the 3M camera-processor. The Itek Platemaster was described earlier in this chapter. It is similar to the 3M camera-processor in construction and operation. However it uses only two processing solutions instead of four and uses a different kind of plate material.

METALPHOTO

In the past, most identification plates for doors, hatches or compartments aboard ships, equipment operation instructions, and many other types of signs or plaques were produced by machine engraving or acid etching processes. Today such items are being produced more economically and faster on light-sensitive aluminum plates in the print shop.

The trade name for this process is Metalphoto. Metalphoto plates processing equipment and chemicals are available through the Navy Supply System. The plates may be ordered in many sizes ranging from 4 X 5 through 24 X 40 inches. Two types of finishes are available: matte or satin. Plate thickness varies from .003 (foil) to .125 of an inch.

As you can see in fig. 10-27, Metalphoto plates consist of an aluminum base which has a light-sensitive coating impregnated into the porous metal surface. These plates are available coated on either one side or both sides. After the plates have been exposed and processed the photographic image is permanently sealed within the metal. This produces an image that is as durable as the metal itself. Metalphoto plates may be done in many colors and many combinations of colors.

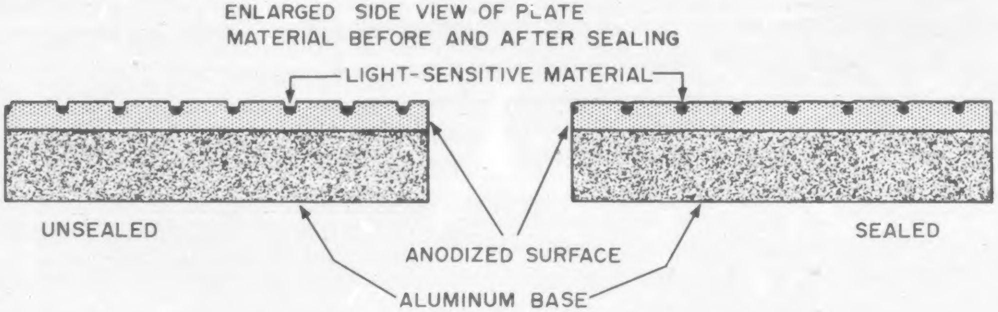
Handling and Storage

As with all kinds of photographic materials, Metalphoto plates must be handled and processed under safelights. The coating on the plates is color blind to red and yellow light, so you may use either type of safelight in the processing area. Safe working distance from the safelights is 4 to 6 feet.

Do not remove a plate from the package until you are ready to use it, and reseal the package carefully to prevent stray light from hitting the unexposed plates. If you expose several plates in a group and plan to process them later, interleave each plate with paper so the surface of the plates won't become scratched or marred.

You must keep the working area and processing equipment clean in order to produce good Metalphoto plates. Pay special attention to the negative and vacuum frame used to expose the plates. They can pick up dirt or chemicals and transfer it to the plates.

All Metalphoto processing chemicals should be stored in glass or plastic containers. The intensifying solution must be stored in a nonmetallic container. The plates may be processed in standard darkroom trays, however the sealing step should be done in an aluminum or stainless steel tank.



113.165X

Figure 10-27.–Cross section of a Metalphoto plate before and after sealing.

For best results, the temperature of the working and storage areas of the plates and processing solutions should be maintained between 68 and 75 degrees.

PROCESSING

High contrast line or halftone negatives produce the best results with these plates. The use of a contact frame or vacuum frame is necessary to get proper contact between the unexposed plate and the negative. In many shops the platemaker exposure unit doubles as the vacuum frame used to expose the Metalphoto plates. Of course it must be moved into a safelit area such as the darkroom in order to be used with Metalphoto.

A light source high in ultra-violet light must be used to expose the plates. Since light sources vary in intensity, you will have to make a series of test exposures to determine the correct exposure time with your equipment. Normal exposures for various types of light sources vary from two to thirty seconds.

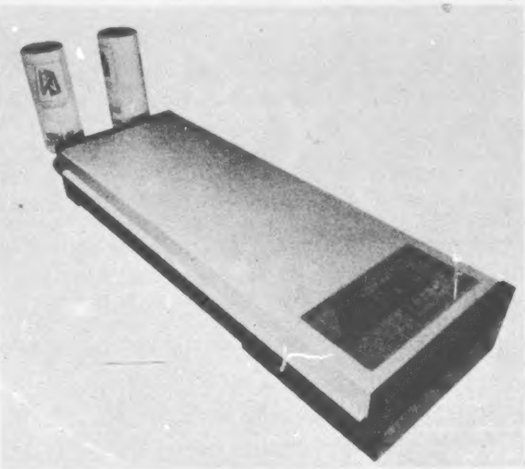
Development and Fixing

You can develop and fix Metalphoto plates in trays like sheet film, or a special processor can be used to automatically develop and fix each plate. (See fig. 10-28.)

The processor will handle all thickness and sizes of plates without any adjustments. Before use, it must be filled with the developer and fixer solutions and then allowed to run for about 30 seconds to allow the solutions to become distributed throughout the roller system. The plates are fed into the processor with the exposed side down. In less than a minute the plates emerge from the processor with the image developed and fixed.

If you are processing Metalphoto plates in trays, you should thoroughly wet the plate with water before placing it in the developer. Then submerge it quickly into the tray with a sliding motion with the exposed side of the plate facing you. Normally the plates are developed 3 to 4 minutes with a slight tray agitation.

When you have completed developing the plate, rinse it for one minute under running water. Then immerse it for one minute under running water. Then immerse it in the fixing solution for 2 minutes with some tray agitation. After fixing the plate, rinse it again for one minute in running water.



57.739X
Figure 10-28.—A Metalphoto Processor.

After the plates have been fixed they may be handled under normal lighting. Inspect each plate for stains or other markings. The removal of these stains will be discussed shortly.

Intensifying

After the plates have been developed, the image is a sepia (brownish) color. To obtain a dense black image it's necessary to completely immerse the plates in another chemical solution called Metalphoto Image Intensifier. The plates should be kept in the intensifier until the image appears blue-black to your eye. The total time of intensifying will vary from 1 to 5 minutes, depending upon the strength of the solution. It is best to work in a well lighted area while you are intensifying the plates so you can tell when the image is completely blue-black.

You have seen earlier that you cannot use metal containers for the intensifier. A glass, plastic, or rubber container must be used.

Sealing

Sealing the plates is the step that closes the porous surface of the plates. It is best to suspend the plates vertically in the sealing bath. Plates sealed in a tank should be kept separated by placing clothespins or metal clips along the sides. If it is necessary to seal a plate flat in a tray, be sure the image side is up. Never seal two plates in a tray at the same time.

For maximum durability and shorter sealing time, you should use Metalphoto Sealing Additive DSA-300. Mix the sealing additive with distilled or de-ionized water; heat the solution to between 205° and 212° F and immerse the plate in this solution for a minimum of 5 minutes. If the additive is not available, you should immerse the plate for a minimum of 30 minutes in distilled or de-ionized water heated to the boiling point throughout the period.

Rinse all traces of the sealing additive from the plate as soon as it is removed from the sealing solution. If the sealing additive dries on the plate, scrub the plate lightly with a damp, soft cloth and a common household scouring powder before you attempt to polish it.

Polishing

The finished plate may be polished with a variety of home polishes, such as Simoniz, Hi-Lite, or Johnson's Pride. Be sure the plate is thoroughly dry before polishing.

Stain Removal

For removing spots, fingerprints, or chemical fog, you should prepare a stock solution consisting of 1 gram of potassium ferricyanide to each ounce of water. From this, prepare a working solution consisting of 1 ounce of stock solution diluted with water to make 32 ounces of working solution.

Stains and fog must be removed immediately after the plate is fixed. A plate requiring clean-up should be transferred directly from the fixing bath to a tray containing the working solution of potassium ferricyanide. Light, overall fog generally disappears in 15 seconds. If the plate has not cleared fully at the end of this time rinse it under tap water and return it to the fixing bath; then repeat this step. To remove spots or stains locally after fixing, saturate a cotton swab or Q-tip with the stock solution and rub the affected area lightly until the stain is removed. Then bathe the entire plate in a tray of working solution to ensure a uniform background. You can remove marks or mars caused by plates rubbing together during processing by scrubbing the area lightly with a household scouring powder after the plate has been sealed.

CHAPTER 11

THE OFFSET PRESS

KINDS OF PRESSES

Presses are generally designated by size, model, and manufacturer or distributor; whether they are single or multicolor; whether they print on one or on both sides of the sheet; or whether they are sheet or roll-fed.

Size and Types of Press

When one speaks of a Harris L-125-B press, he is referring to a product of the Harris-Intertype Corporation. The "L" in this case stands for "Lithographic." The first digit in the model number represents the number of colors the press is equipped to run. For example, a "1" represents a single-color press; "2" would represent a two-color press, and so on. The "25" represents the longest dimension of the sheet capacity of the press. And the letter "B" is used by the manufacturer to distinguish this particular model from its predecessors in the 19" X 25" class.

Although larger presses are built, most Navy presses range in size from 10" X 14" to 23" X 15" (or smaller) class are sometimes called duplicators because they are used as "office equipment" as well as in the litho shop. (See fig. 11-1.)

Web Presses

Roll-fed presses are usually referred to as "web" presses. As you will see later in this book, paper comes out of the papermaking machine in a long strip called a "web" which is wound on a roll. The paper may later be unrolled and cut into sheets or it may be left in roll form. Printing presses designed to feed paper from the roll instead of in separate sheets are known as "web-fed" presses. Once the web of paper is threaded through these presses, all printing operations are continuous. Therefore these presses are capable of turning out work at tremendous speeds. (See fig. 11-1.)

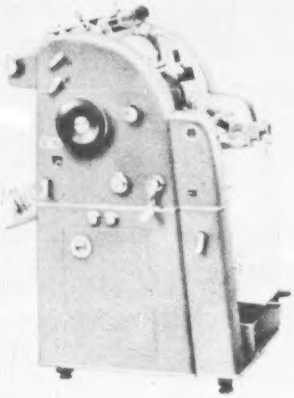
They are used mostly for work requiring extremely long runs and for specialty and publications printing. Although the method of feeding and the design of these presses differ somewhat from that of sheet-fed presses, they operate on the same principle as other offset presses.

(Note.–You should not confuse web-fed presses with the American Type Founder's sheet-fed presses. Pressmen sometimes refer to the ATF presses as "Webs" because the earlier models of these presses were known as "Webendorfer" presses.)

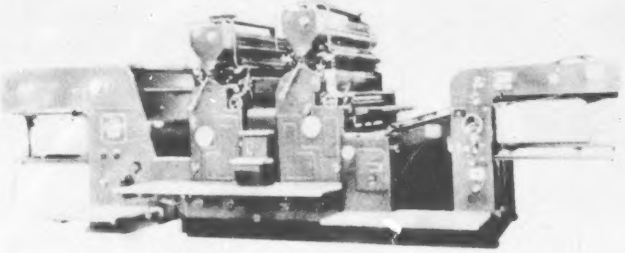
Sheet-Fed Presses

The presses found in the average lithographic shop are sheet-fed. Most of these presses are built to pick up the individual sheets from a feed table and deliver them, one at a time, down a feedboard to the printing unit. Usually the sheets travel down the feedboard singly with a slight gap or space separating the tail of one sheet and the head of the next one. This is known as "single-sheet feeding" or "successive feeding."

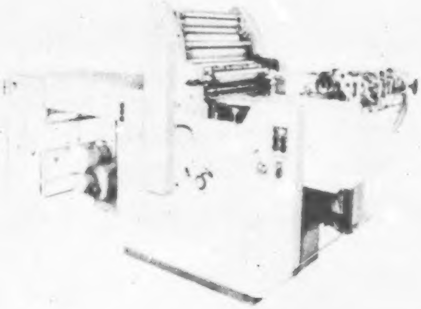
On some sheet-fed presses, the sheets overlap one another as they travel down the feedboard, as shown in figure 11-2. This is known as "stream feeding." When the sheets overlap in this manner, it is possible to run them down the feedboard at a slower speed than that required for single-fed sheets. This makes for better register, because at slower speeds, the sheets are less likely to bounce away when they strike the register guides at the end of the feedboard. It also eliminates the necessity for using a slowdown mechanism (a device used on some presses



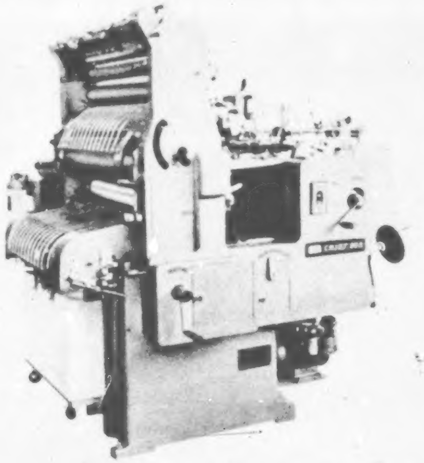
OFFSET DUPLICATOR



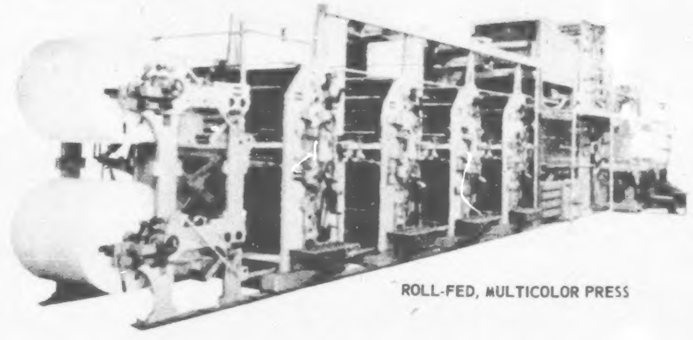
SHEET-FED, TWO-COLOR PRESS



SHEET-FED, SINGLE-COLOR PERFECTOR



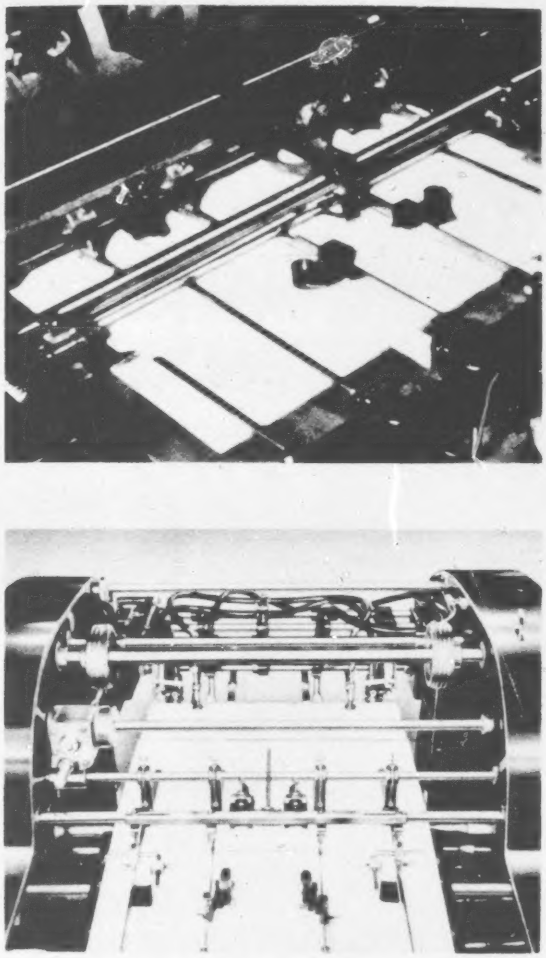
SHEET-FED, SINGLE-COLOR PRESS



ROLL-FED, MULTICOLOR PRESS

57.214

Figure 11-1.—Types of presses. The first American roll-fed press was designed and built by J. F. Webendorfer. It was called a "web" press—not because of the inventor's name—but because it was fed from a web of paper. The American Type Founders bought the Webendorfer Company in 1938 and all Webendorfer offset presses then became known as ATF Webendorfers. ATF gradually dropped the name Webendorfer and its presses are now designated by such names as the Chief 20, the Chief 22, and so on. However, some pressmen still refer to ATF presses as "Webendorfers" or "Webs."



57.215X

Figure 11-2.—Comparison of single-sheet feeder, above, and stream feeder, below.

to slow down the sheets momentarily before they reach the guides).

Multicolor Presses

Most offset presses are single color; that is, they have only one printing unit and can print only one color at a time. If more than one color is required, the stock is allowed to stand until the ink from the first run is set-up (dry), and the sheets are then run through the press again to print the second color.

Presses capable of printing more than one color in a single run are known as multicolor presses. These presses consist essentially of a series of single printing units combined into one machine. (See fig. 11-3.)

The pressman can run a different plate and different color of ink in each unit. The paper can be fed in either sheet or roll form. Since the inks do not have time to dry between impressions, pressmen generally run a stiff ink in the first printing unit and use progressively softer inks in each of the other units. The stiff inks have more tack and tend to pull the softer inks to them rather than fusing with the subsequent colors as the stock runs through the press.

Perfecting Presses

The ordinary press prints on only one side of the sheet. To back up the sheet, it is necessary to let the ink dry and then turn the paper over and run it through the press a second time. There are presses which are equipped to print on both sides of the sheet in a single run, of course. These presses are known as perfectors. Perfecting presses may be either web or sheet fed and may be single or multicolor. The operating principle for these presses is shown in the diagram in figure 11-3.

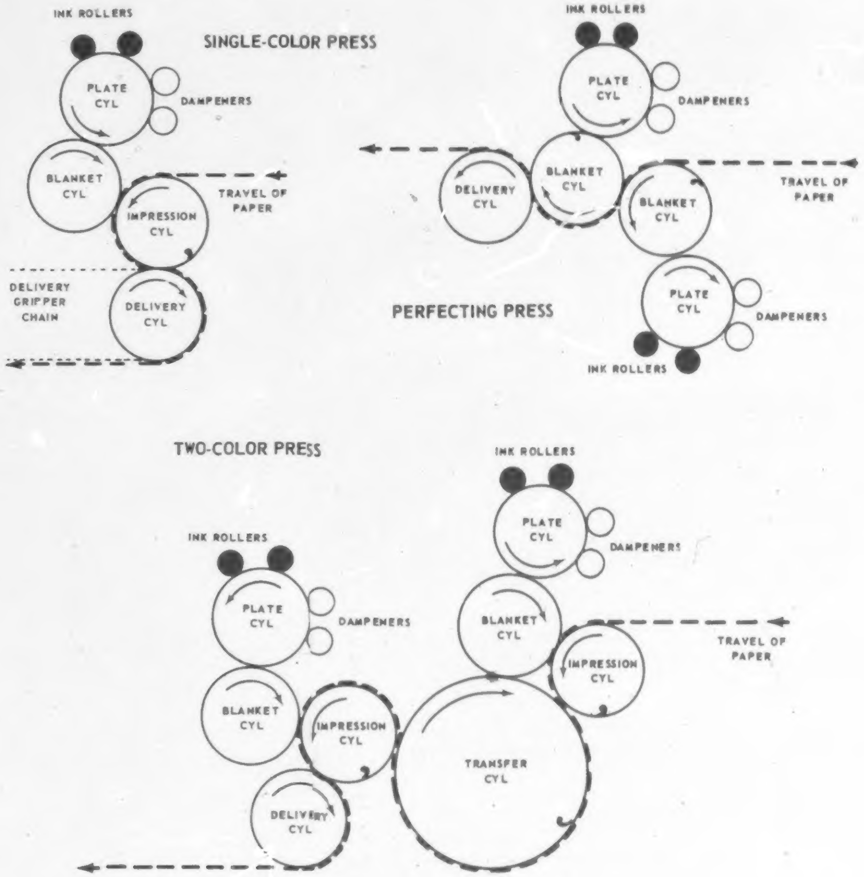
Dry Offset Presses

Dry offset printing (sometimes called letterset) is a combination of both offset and letterpress. Dry offset presses print on the blanket with relief plates, like the Dycril plate discussed in chapter 10. The blanket, in turn, transfers the image to the paper. No dampening system is required on these presses, because the image on the plate is raised slightly, as in letterpress printing.

As you have seen earlier, the 3M Company also manufactures a flat-surfaced presensitized (Driographic) plate which does not require water. The image is not raised on these plates, but the nonprinting areas are coated with a material that repels ink when the job is run. These plates can be run on any offset press, provided the operator uses a special ink and racks back his dampening rollers when he makes the run.

Navy Presses

From this, you can see that there are a number of different types of offset presses. However, many of the presses mentioned here are used for specialty or publications printing and are not found in the average shop. The discussion in this book will be limited to


INK ROLLERS
SINGLE-COLOR PRESS
PLATE CYL
DAMPENERS
BLANKET CYL
IMPRESSION CYL
TRAVEL OF PAPER
DELIVERY GRIPPER CHAIN
DELIVERY CYL
INK ROLLERS
PLATE CYL
DAMPENERS
BLANKET CYL
DELIVERY CYL
BLANKET CYL
TRAVEL OF PAPER
PLATE CYL
DAMPENERS
PERFECTING PRESS
INK ROLLERS
TWO-COLOR PRESS
INK ROLLERS
PLATE CYL
DAMPENERS
INK ROLLERS
PLATE CYL
DAMPENERS
BLANKET CYL
BLANKET CYL
IMPRESSION CYL
TRAVEL OF PAPER
IMPRESSION CYL
TRANSFER CYL
DELIVERY CYL

57.216

Figure 11-3.—On single-color presses, impression cylinder grippers close on the sheet at the end of the feedboard and draw it into the printing unit where it is pressed against the rubber blanket by the impression cylinder to receive the inked image. After the "impression", the sheet is released to delivery grippers which carry it to the delivery platform. On two-color presses, like the one shown here, the impression cylinder grippers release the sheet to grippers on a transfer cylinder as the sheet comes out of the first printing unit. The transfer cylinder grippers, in turn, release the sheet to the grippers on the impression cylinder in the second printing unit. The second color is printed as the sheet passes through this unit and the sheet is then released to the delivery grippers. The transfer cylinder has twice the diameter and rotates at half the speed of the impression cylinder, giving the ink time to set between the first and second impressions. On perfecting presses, like the one shown here, the sheet is drawn into the printing unit by grippers on the lower blanket cylinder. It is then transferred to grippers on the upper blanket cylinder. The printing pressure goes on automatically to bring the two blanket cylinders together and both sides of the sheet are printed simultaneously before the paper is released to the delivery unit. The cylinder arrangement on multicolor and perfecting presses vary from one type of press to another, of course. On some two-color presses, for example, there is no transfer cylinder. A single impression cylinder serves both printing units and both colors are printed as the sheet is drawn around this cylinder.

single-color, sheet-fed (pile feeder) presses of the type which you are most likely to be using in your work as a Navy Lithographer.

THE OFFSET PRESS

If you will look at the diagram of the printing unit of the single-color press shown in figure 11-4, you will see that it consists of an ink fountain and rollers, a water fountain and rollers, and three metal cylinders. The plate is attached to the top cylinder; a rubber blanket is attached to the second; and the third carries the paper through the press forcing it against the rubber blanket to make the printed impression. (You will also see a fourth cylinder, known as the skeleton cylinder. The skeleton cylinder is not discussed until later in this chapter, however, because it is considered to be a part of the delivery rather than the printing unit of the press.)

When the press is in operation, the cylinders revolve, and the plate is carried first under the dampening rollers, then under the inking rollers, and finally against the rubber blanket. The dampening rollers moisten the nonprinting areas of the plate, but do not affect the greasy image. The ink rollers then ink only the image areas, because the ink will not stick to a moistened surface.

After the plate passes under the ink rollers, it contacts the blanket cylinder, transferring the inked image to the blanket. The blanket, in turn, offsets or prints the wet image onto the paper which is forced against it by the impression cylinder. The image reads left-to-right on the plate; backwards on the blanket; and left-to-right again on the paper.

Of course, the printing unit is only a part of the offset press. As you can see in figure 11-4, the modern press is also equipped with an automatic feeder and a delivery unit. The feeder is built to deliver the sheets one at a time down the feedboard to the printing unit. At the end of the feedboard, a set of metal gripper fingers (contained in a recess in the impression cylinder) close on the edge of the paper and draw it between the cylinders. As the sheet comes out of the printing unit, the cylinder grippers open and release it to a set of delivery grippers which carry it to the end of the press and release it on a pile of printed sheets.

Study figures 11-4 and 11-5 and trace the paper from the feed pile, through the printing unit, and finally to the delivery table. As soon as you have the overall picture of the press fixed in your mind, you can proceed with a closer study of its operating units.

INKING SYSTEM

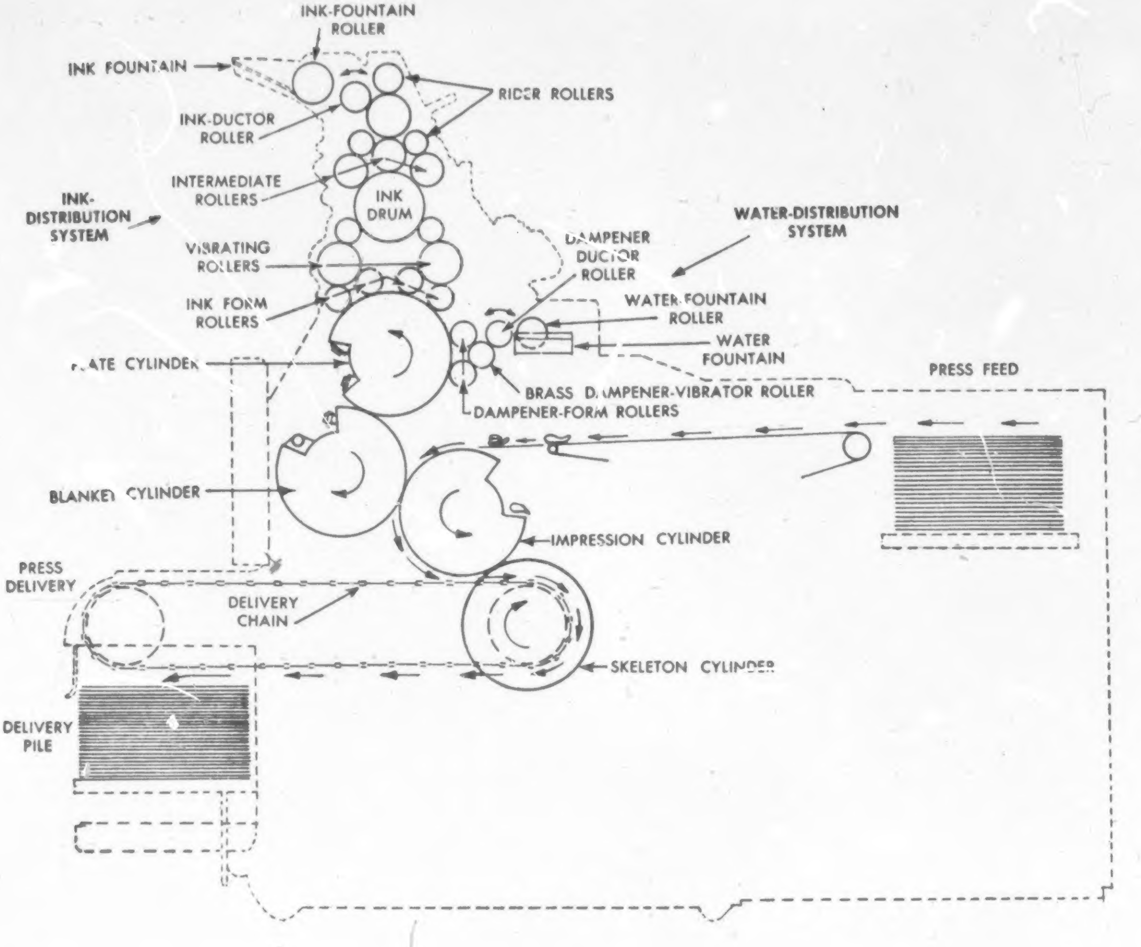
The inking system is composed of an ink fountain and a set of metal and rubber or composition rollers. The number of rollers varies with the size of the press. If the press is large, more rollers are required to work out and distribute the ink.

The fountain consists essentially of a steel blade attached to a metal roller in such a way as to form a reservoir or trough for the ink. (See fig. 11-6.) The pressman generally fills the fountain with ink each morning; and at the end of the day, he removes the ink and cleans the fountain and rollers.

When the press is in operation the metal fountain roller revolves in the fountain, picking up a thin film of ink which it yields to the ductor roller. (See fig. 11-6.) The ductor roller swings back and forth alternately contacting the fountain roller and a distributing roller. Since the distributing roller is in continuous contact with the other rollers, it receives the ink from the ductor and transfers it to the others. The distributing and idler rollers break down the ink before it reaches the oscillating (vibrator) rollers. The vibrator rollers move back and forth sidewise as they rotate, spreading the ink evenly over the form rollers. The form rollers then ink the image on the plate.

Raising and Lowering the Form Rollers

Small presses generally have two form rollers, but larger presses have more. A handle or crank is provided for lowering the rollers against the plate or for lifting them out of contact with it, and the pressman must raise or lower the rollers manually when he is operating the smaller presses.


INK-FOUNTAIN ROLLER
INK FOUNTAIN
RIDER ROLLERS
INK-DUCTOR ROLLER
INTERMEDIATE ROLLERS
INK DRUM
INK-DISTRIBUTION SYSTEM
VIBRATING ROLLERS
DAMPENER DUCTOR ROLLER
WATER-DISTRIBUTION SYSTEM
INK FORM ROLLERS
WATER-FOUNTAIN ROLLER
WATER FOUNTAIN
PLATE CYLINDER
BRASS DAMPENER-VIBRATOR ROLLER
DAMPENER-FORM ROLLERS
PRESS FEED
BLANKET CYLINDER
IMPRESSION CYLINDER
PRESS DELIVERY
DELIVERY CHAIN
SKELETON CYLINDER
DELIVERY PILE

52.217

Figure 11-4.—Diagram of a sheet-fed, single-color press.

On the larger presses, the rollers function automatically. They drop against the plate when the pressman throws on the impression (pushes a lever to bring the cylinders together so that the press will print) and they rise again when the impression is thrown off. Of course, the pressman must still raise and lower them by hand when he is mounting a plate or making roller adjustments, or putting a plate on the press.

Fountain Keys

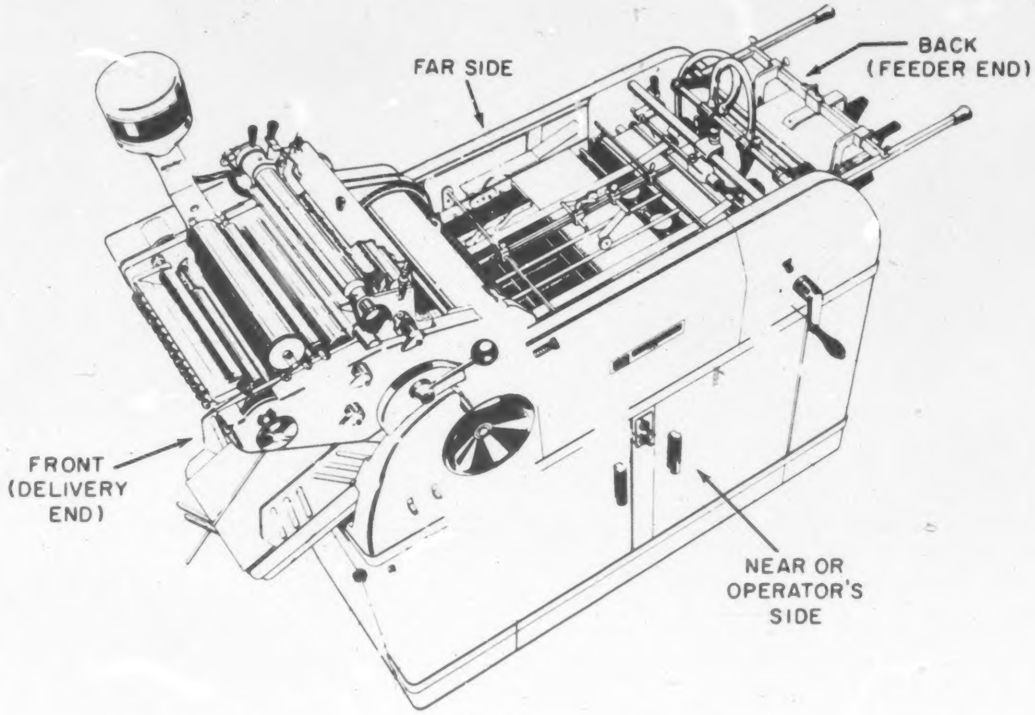
The supply of ink is regulated at the fountain by means of a series of thumbscrews (keys) like those shown in figure 11-6.

By adjusting these keys, the pressman can move a blade to or away from the fountain roller. The farther away the blade is moved, the thicker will be the film of ink carried on the roller, and the greater will be the amount of ink fed to the plate.

The adjustment of these keys not only enables the pressman to control the amount of ink, but also enables him to control its distribution. (See fig. 11-7.) He can set them to distribute the ink evenly over the rollers, or he can make the ink run heavier (or lighter) in one area than in another.

Ink Feed Ratchet

The supply of ink is further regulated by a ratchet which governs the speed (number of



PRESS TERMS

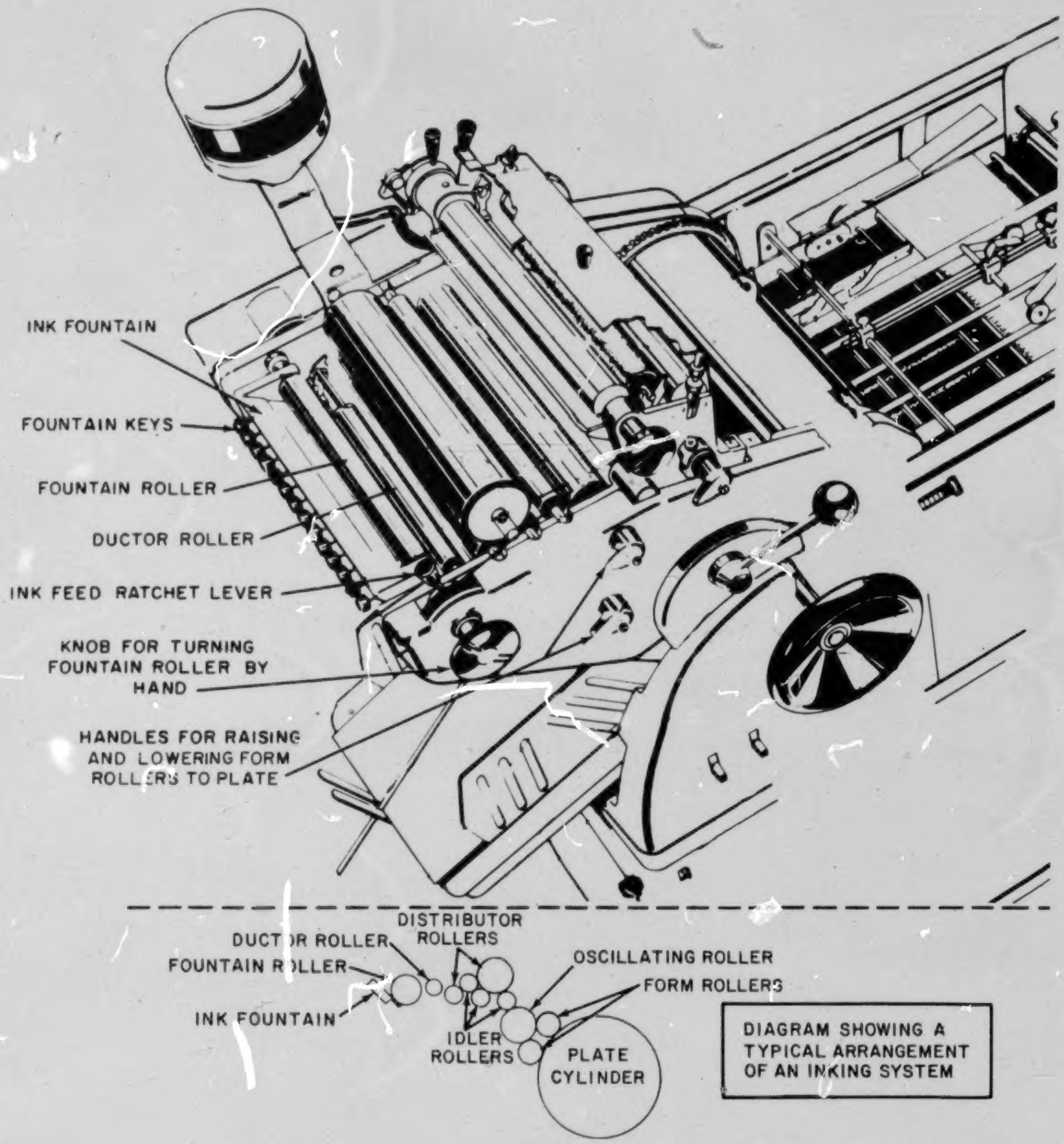
THIS MANUAL USES THE FOLLOWING TERMS IN REFERENCE TO THE PRESS:

FRONT------DELIVERY END.
BACK-------FEEDER END.
NEAR SIDE---OPERATOR'S SIDE. (THE SIDE ON WHICH THE OPERATING CONTROLS ARE FOUND.)
FAR SIDE----THE FLYWHEEL OR NONOPERATING SIDE.

NOTE.–THE TERMINOLOGY USED IN DESCRIBING PRESS PARTS VARIES FROM PRESS TO PRESS AND FROM MANUFACTURER TO MANUFACTURER. FOR EXAMPLE, ON SOME PRESSES, THE CALIPER IS REFERRED TO AS THE TWO-SHEET CHOKE. ON OTHERS, IT IS CALLED THE MULTIPLE-SHEET DETECTOR. SINCE A VARIETY OF TERMS FOR THE SAME PART MIGHT CONFUSE THE READER, THIS TEXT HAS ATTEMPTED TO STRIKE A HAPPY MEDIUM AND APPLY A SINGLE TERM TO ALL LIKE PARTS IN THE CHAPTERS WHICH FOLLOW.

57.568X

Figure 11-5.–Press terms.


INK FOUNTAIN
FOUNTAIN KEYS
FOUNTAIN ROLLER
DUCTOR ROLLER
INK FEED RATCHET LEVER
KNOB FOR TURNING FOUNTAIN ROLLER BY HAND
HANDLES FOR RAISING AND LOWERING FORM ROLLERS TO PLATE
DISTRIBUTOR ROLLERS
DUCTOR ROLLER
FOUNTAIN ROLLER
OSCILLATING ROLLER
FORM ROLLERS
INK FOUNTAIN
IDLER ROLLERS
PLATE CYLINDER
DIAGRAM SHOWING A TYPICAL ARRANGEMENT OF AN INKING SYSTEM

57.218X

Figure 11-6.—The inking system on a small offset press. Most presses use a combination of metal and rubber (or plastic) rollers. Some of the ink rollers are larger in circumference than the others so that they will not contact each other in the same place each time they rotate. The form rollers may be equal in circumference or they may be varied in size to provide better ink distribution to the plate.

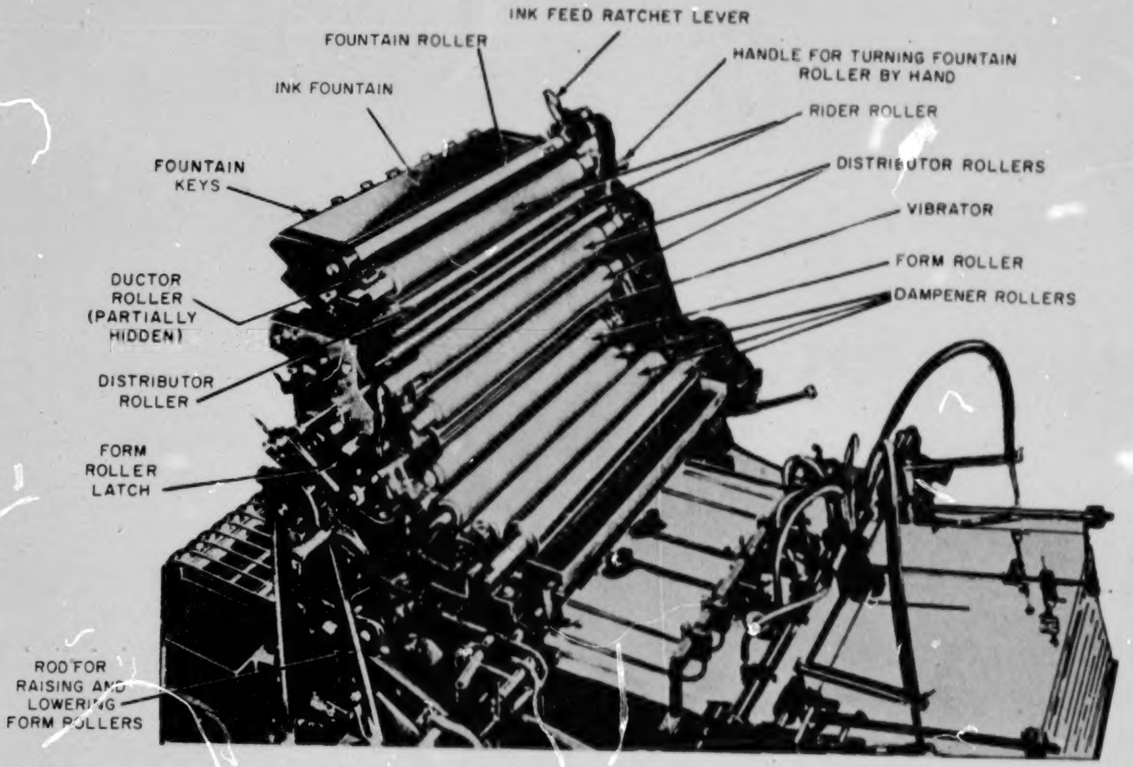

INK FEED RATCHET LEVER
FOUNTAIN ROLLER
HANDLE FOR TURNING FOUNTAIN ROLLER BY HAND
INK FOUNTAIN
RIDER ROLLER
FOUNTAIN KEYS
DISTRIBUTOR ROLLERS
VIBRATOR
FORM ROLLER
DUCTOR ROLLER (PARTIALLY HIDDEN)
DAMPENER ROLLERS
DISTRIBUTOR ROLLER
FORM ROLLER LATCH
ROD FOR RAISING AND LOWERING FORM ROLLERS

Figure 11-7.—Inking system on one of the larger presses.

57.219X

revolutions per minute) of the fountain roller. The farther the roller travels while it is in contact with the ductor roller, the greater will be the amount of ink transferred to the ductor.

Most pressmen operate with a minimum of ink on the fountain roller, regulating the throw (speed) of the roller, as necessary, to control the amount of ink supplied to the plate.

By pulling a lever, like that shown in figure 11-6, the pressman can stop the fountain roller from turning or break the contact between the fountain roller and the ductor, and thus completely shut off the ink supply. He can also turn the fountain roller by hand (with a knob or lever) if it is necessary to increase the ink feed momentarily during a run.

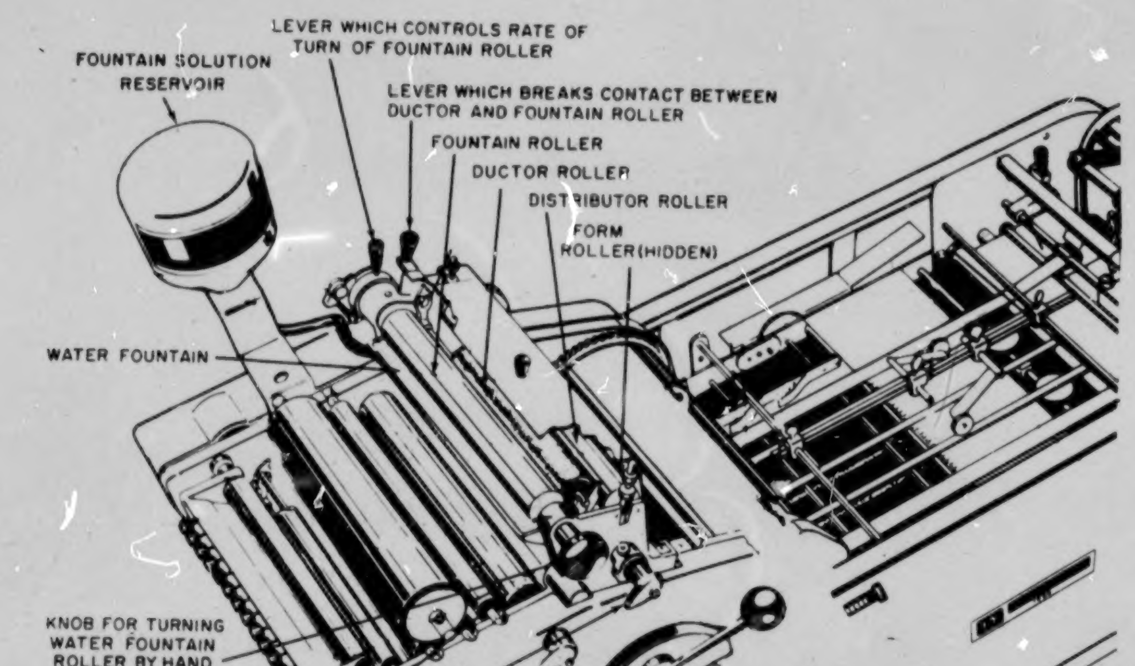
Ink Roller Covers

The ink rollers are not normally covered. However, pressmen sometimes cover them with a transparent sleeve made of a fluorocarbon resinous material called Teflon. Teflon covers make the rollers easier to clean and provide certain inking advantages. You will learn more about them in chapter 15 in the discussion of inking problems.

DAMPENING SYSTEM

The dampening system is similar to the inking system, except that the ductor and form rollers are generally covered with a close-woven cloth, known as Molleton. (See fig. 11-8.) (This text refers to all dampener covers as molleton covers; however, there are other types of cloth covers, such as Aquatex, Seamol, Hyton and A-M Adhesive Backed Spiral Wind On, and many pressmen use these instead of molleton covers.)

The fountain roller revolves in a pan of water mixed with a chemical solution known as fountain etch. It transfers a thin film of this


LEVER WHICH CONTROLS RATE OF TURN OF FOUNTAIN ROLLER
FOUNTAIN SOLUTION RESERVOIR
LEVER WHICH BREAKS CONTACT BETWEEN DUCTOR AND FOUNTAIN ROLLER
FOUNTAIN ROLLER
DUCTOR ROLLER
DISTRIBUTOR ROLLER
FORM ROLLER(HIDDEN)
WATER FOUNTAIN
KNOB FOR TURNING WATER FOUNTAIN ROLLER BY HAND
KNOB FOR RAISING AND LOWERING FORM ROLLER TO PLATE
FOUNTAIN ROLLER
DUCTOR ROLLER
DISTRIBUTOR ROLLER
FORM ROLLER
PLATE CYLINDER
DIAGRAM SHOWING A TYPICAL ARRANGEMENT OF A DAMPENING SYSTEM

57.220X

Figure 11-8.—The dampening system on a small offset press.

water (fountain solution) to the ductor roller. The ductor roller, in turn, yields the water to a distributor roller which passes it on the form rollers. Some of the smaller presses have only 1 form roller, but most presses have 2. (See figs. 11-8 and 11-9.)

As a rule these rollers do not go off and on automatically. The operator must move them to or away from the plate with a handle or crank.

Water Feed Ratchet

The water fountain is simply a metal pan. It has no blade or keys for controlling the distribution and flow of the water. The water supply is controlled by a ratchet adjustment which governs the number of revolutions per minute of the fountain roller, or by an adjusting screw or cam which governs the length of time that the ductor is in contact with the fountain roller.

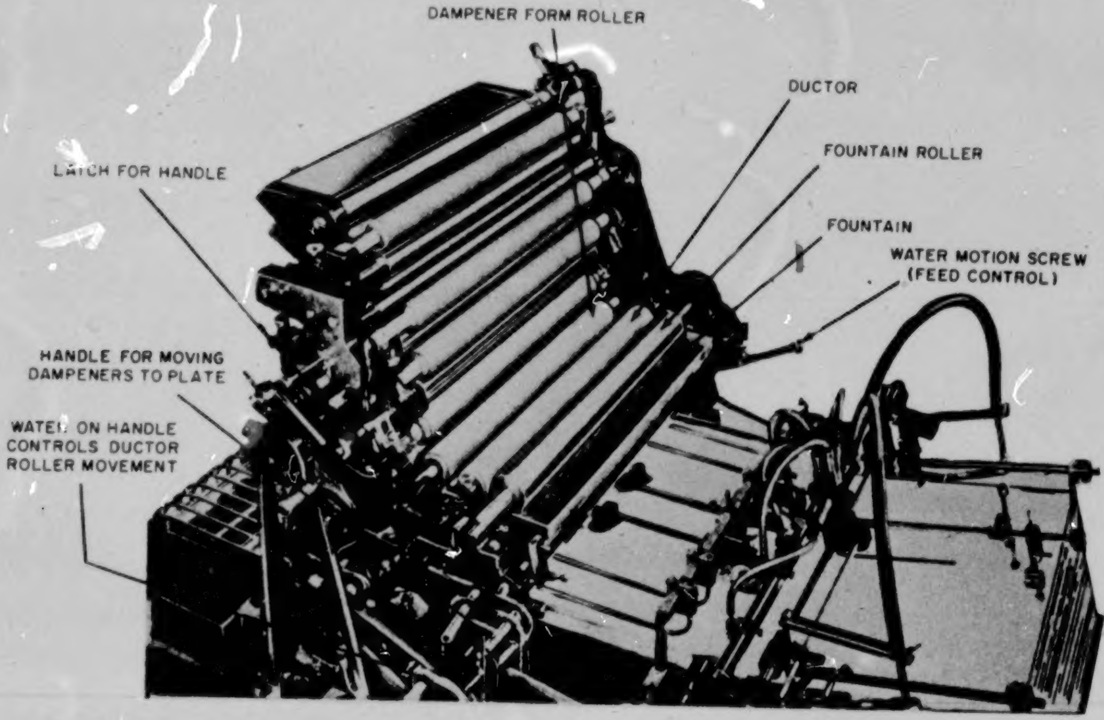
Water Stops

Some pressmen attach water stops (small strips of metal with rubber blades) to the fountain. The rubber blades ride against the fountain roller and squeegee off some of the water and thus reduce the supply reaching the dampeners in local areas. Water stops are standard equipment on the larger presses, and they are also used occasionally on some of the smaller presses.

On some presses, the operator can shut off the water by pulling a lever which stops the fountain roller from turning on the fountain. On others, he pulls a lever which breaks the contact between the ductor and fountain roller.

Fountain Solution

The fountain solution requires careful control. If the chemicals in the water are too strong,


DAMPENER FORM ROLLER
DUCTOR
FOUNTAIN ROLLER
LATCH FOR HANDLE
FOUNTAIN
WATER MOTION SCREW (FEED CONTROL)
HANDLE FOR MOVING DAMPENERS TO PLATE
WATER ON HANDLE CONTROLS DUCTOR ROLLER MOVEMENT

57.221X

Figure 11-9.—The dampening system on one of the larger presses.

the image will disintegrate or "walk off" the plate during the run. On the other hand, if they are too weak, the nonprinting areas of the plate may become receptive to ink and "scum" will develop.

A prepared fountain etch is supplied by the manufacturers of the smaller presses, and the pressman simply mixes a portion of this etch with the correct amount of water, following the directions on the bottle. Prepared solutions are also available for the larger presses, but in many cases, the etches for these are mixed in the shop. Formulas for fountain etches are listed in Appendix II.

It is possible to run presensitized, diffusion transfer, and similar types of plates with the standard fountain solution listed for aluminum plates. However, it may be necessary to dilute the fountain solution, particularly if the solution tends to attack the image on the plate. The instructions that come with each package of plates generally recommend the strength of fountain solution to be used. Direct-image paper plates sometimes require a stronger fountain solution than presensitized metal plates, although it is often possible to obtain satisfactory results from these plates simply by increasing the water and ink feed. Special solutions are often required for running plates made by the camera-direct process. The instructions that come with each package of plates generally recommend the strength of the fountain solution to be used.

When only one type of plate is used in the shop, the problems of inking and moistening are relatively simple. However, if a shop uses a variety of plates, the pressman may find it necessary to make press adjustments when he switches from one type of plate to another.

Since cloth-covered dampeners tend to pick up chemicals and other impurities from each type of plate being run, many shops keep two or more sets of dampeners on hand and use each set only when they are running a specific type of plate.

Water and Ink Balance

Good reproduction requires a proper balance of water and ink. Too much water will cause the printing to be gray and dull, and if the chemicals in the water are too strong, they may undermine the image on the plate.

Too much ink or insufficient water, on the other hand, will cause the plate to take ink in the nonprinting areas. Too much ink may also cause letters to thicken and halftone areas to fill in.

Roller Covers

You have just seen that the ductor and form rollers in the dampening system are usually covered with a cloth called molleton. The ductor roller usually has only one cover, but the form rollers on some presses have two. If a roller has two coverings, the inner cover usually consists of a layer of flannel and the outer covering consists of molleton.

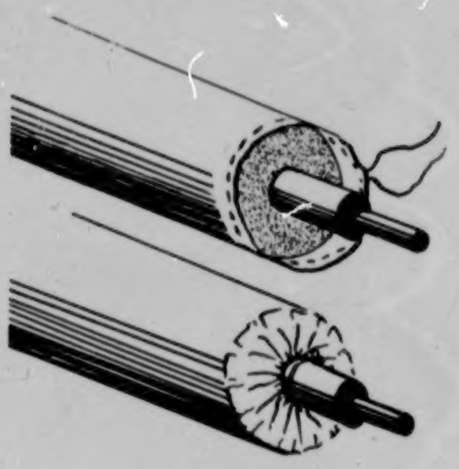
These coverings, particularly the outer one, pick up ink over a period of time and eventually become too dirty to work effectively. The pressman changes the inner covering about once every 6 months, but he may change the outer covering every 4 or 5 weeks, depending on its condition.

Covers come as machine-stitched, open-end sleeves. The pressman simply slips this seamless tubing over the roller and sews a drawstrong on one end, as shown in figure 11-10. After he ties the drawstring, he wets his hands in order to grip the cloth and stretches it as much as possible. He then ties the other end with another drawstring. (Some pressmen do not use the drawstring method; they simply sew up both ends of the tubing with cross stitches.)

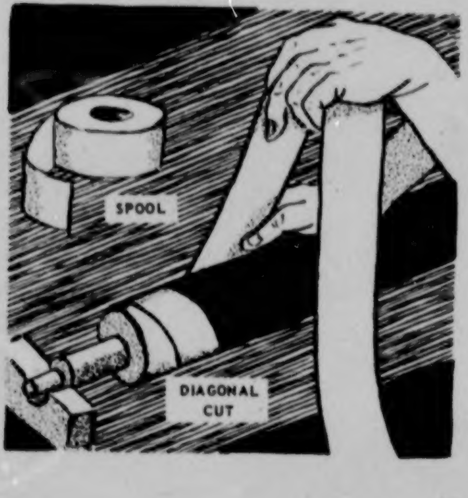
Paper Covers

In some shops, paper coverings are used on the form rollers instead of cloth covers. Paper covers tend to stay cleaner longer, and they also provide more uniform contact with the plate. However, paper covers are not interchangeable with cloth covers. To switch to paper covers, it is necessary to have the roller cores recovered with a softer rubber, ground to precision dimensions.

The parchment used for paper covers comes in long, narrow strips on spools, like the one shown in figure 11-11, and it is wrapped around

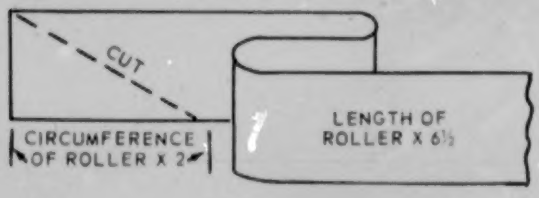


57.222
Figure 11-10.—Method of securing end of cloth cover on dampening roller. Covering may consist of Molleton, Aquatex, Seamol, or similar material. Seamless tubing comes in different sizes. The pressmen must be familiar with the size used on his particular press.



57.223
Figure 11-11.—Wrapping a form roller with a paper covering. This method of wrapping results in a seamless, double-wrapped covering. Paper covers are also available as seamless sleeves.

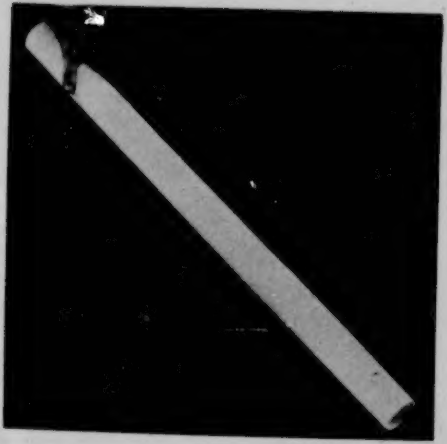
the roller in a spiral fashion, with the edges of the strip either butting against each other or overlapping one another on the roller. The pressman cuts a strip about 6 1/2 times the length of the roller. He makes a diagonal cut at one end of the strip, in the manner shown in figure 11-12, and places the diagonally-cut edge parallel with the end of the roller when he starts wrapping so that the tape will be wrapped around the roller at an angle. (See fig. 11-11.) He overlaps the first turn and continues wrapping, overlapping each succeeding turn until he reaches the other end of the roller. He then slips a rubber band over each end of the roller to keep the wrapping from coming loose when the press is running.



57.224
Figure 11-12.—The pressman marks off a distance equal to twice the circumference of the roller and marks the paper dampener strip. Then he draws a diagonal line from this mark to the upper left corner of the strip and cuts along this line. He places the cut edge parallel with the end of the roller as shown in figure 11-11, when he begins wrapping the dampener.

The 3M Slip On cover is similar to the parchment covers just described except that it comes in a sleeve and does not require winding. (See fig. 11-13.) For best results, it should be used with a special roller provided by the 3M Company.

If the sleeve gets dirty or if the pressman is switching from a dark to a lighter color of ink, he generally cleans the roller covering with 3M Cleaner-Conditioner or any non-oily press solvent. If it is necessary to change the cover, he removes the roller from the press and tears off the dirty sleeve. He then cleans the roller with a mild solvent and slips on the new sleeve, allowing it to overhang an equal amount at both ends of the roller. After this, he wets the cover under running water; the moisture shrinks the covering and makes it hug the roller. He then replaces the roller (in the same position) in the press. No run-in period is required and it is not necessary to reset the roller tension when changing roller covers.



57.740

Figure 11-13.—3M sleeve.

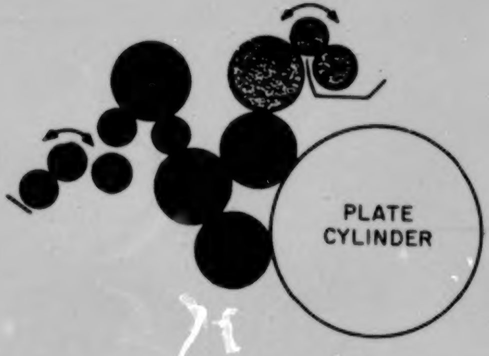
Water-to-Ink Roller Dampening Systems

As you will see in chapter 13, the dampening system on the A. B. Dick Offset Duplicators differs from the conventional dampening system described here. On the A. B. Dick presses, the water and ink are both fed to the plate from the same set of form rollers.

When the press is in operation, the ink is distributed over all of the ink rollers and some of those in the dampening system. The fountain solution in turn is distributed to the rollers in the dampening system and also to some of the ink rollers, as shown in figure 11-14. Thus the form rollers are covered with a film of water as well as with a layer of ink. As the plate cylinder travels under these rollers, the rollers give up their moisture to the nonprinting areas of the plate and transfer the ink to the ink-receptive image areas.

The Simflo dampening system found on the Multilith model 85, and the water-to-ink dampening system used on some 17" × 22" and 14" × 20" MGD presses are similar to this in principle. The Dahlgren system, developed for the larger presses is also based on this principle. It can be attached to presses already in use or can be supplied on special order when new presses are purchased.

Although the manufacturers of the presses generally recommend inks and fountain solutions specially formulated for use with their equipment, any good ink or fountain solution can be used on these presses without creating problems of emulsification. Anhydrous grain alcohol is sometimes mixed with the fountain solution. It acts as a wetting agent and increases the effectiveness of the solution. Eight ounces of alcohol are added to each quart of the solution.



57.225X

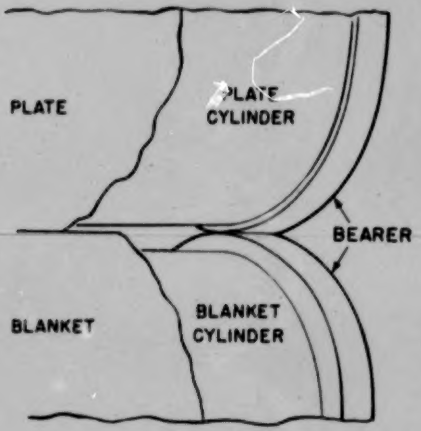
Figure 11-14.—Diagram of the inking and dampening rollers on the A. B. Dick Offset Duplicator, Model 350. When the press is in operation, ink is distributed to all rollers, except the water ductor and fountain roller. Water is distributed over ink form rollers and lower ink oscillating roller as well as over dampener rollers. Water-to-ink dampening systems carry less water than conventional dampeners, and since greasy ink tends to repel water, most of the dampening solution is carried on the surface of the ink and is transferred to the plate before it has time to become emulsified (distributed through the body of the ink as tiny drops of water). A small portion of the water emulsifies with the ink, as is the case on all presses, but experience has shown that a small amount (20 percent or less) of emulsified water does not cause inking trouble. It is only when excessive emulsification occurs due to poor ink or too much water that the ink becomes waterlogged and produces a washed-out print.

However, some pressmen use more when the temperature of the room reaches 80° F or above.

PRESS CYLINDERS

On the larger presses, there is a metal band (bearer) at each end of the plate and blanket cylinders. These bearers maintain the correct separation between the cylinders when the press is in operation. The recessed (undercut) section between the bearers allows for the thickness of a plate or blanket which is clamped around the cylinder. (See fig. 11-15.)

As a rule, the thickness of the plate and blanket is less than the combined depths of the undercut sections of the cylinders. Therefore, it is necessary for the pressman to pack or underlay the blanket and plate with sheets of paper to bring them up to bearer height, so that their surfaces will be in contact with one another.



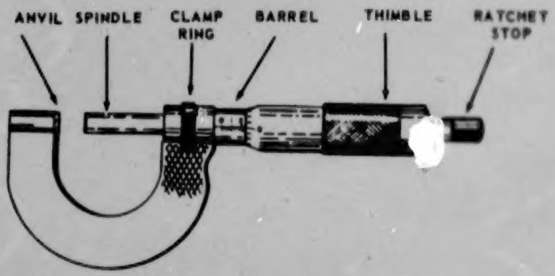
57.226X

Figure 11-15.—Diagram of the plate and blanket cylinders showing the undercut section for plate and rubber blanket. The depth of the undercut section is generally stamped on the end of the cylinder or in the cylinder gap. If it is not, the pressman can determine it by measuring with a packing gage or by placing a straightedge across both cylinder bearers and then measuring the clearance between the body of the cylinder and the straightedge with a feeler gage (a device used for measuring the distance between two surfaces).

But it is not enough for the plate to just contact the blanket. The two must be brought together with a slight pressure so that there will be sufficient "squeeze" for the image to transfer from the plate to the blanket. This means that additional packing sheets must be used so that the plate and blanket will extend slightly above the height of the bearers. The correct pressure depends to some degree on the type of plate and blanket used and on the size of the press. The pressure generally recommended for running presensitized plates on smaller presses is 0.002 of an inch, but larger presses may require 0.003 or 0.004 of an inch pressure. Too little pressure will result in a light, fuzzy, broken image, and too much pressure may result in slur and double printing. Too much pressure also causes friction which shortens the life of the plate.

Although some pressmen prefer to use 0.004 of an inch printing pressure on the larger presses, most pressmen use only 0.003 of an inch. This pressure is usually provided by overpacking the plate 0.001 of an inch above the bearers and overpacking the blanket 0.002 of an inch above the bearers. Some pressmen put all the overpacking behind the plate, however, and others put it all under the blanket. As long as the plate and blanket are both packed to bearer height, the overpacking can be added to either cylinder or can be divided between them in any proportion. Pressmen sometimes manipulate the packing when they are running close-register color work if the paper stretches or shrinks between runs due to moisture changes. Shifting packing from the plate to blanket lengthens the printed image slightly, and transferring packing from the blanket to plate shortens the image on the paper. (You will learn more about paper stretch and shrinkage later in this book.)

To determine the amount of packing that is required, the pressman actually measures the thickness of the plate or blanket with a precision instrument, known as a micrometer. (See fig. 11-16.) He deducts this thickness from the depth of the undercut section (which is generally stamped on the end of the cylinder or in the cylinder gap). He then adds enough packing to make up the difference between the two amounts and to bring the blanket or plate to the recommended printing height.



4.20(57)X

Figure 11-16.–One type of micrometer. Each line on the barrel represents 0.025 of an inch and each line on the thimble represents 0.001 of an inch. The pressman turns the thimble until the measuring faces clamp the plate. He then counts the number of lines (not including the zero line) on the barrel and multiplies this number by 25. The result is a reading in thousandths of an inch. To this, he adds the number of lines on the thimble. The total is the thickness of the plate.

When mounting a plate or blanket, pressmen generally "mike" it at several points, because its thickness may vary from one area to another.

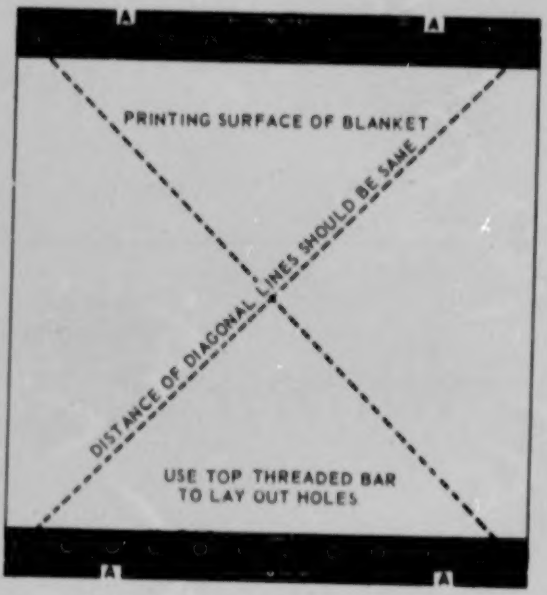
The procedure just discussed does not apply to the small offset presses. Normally, no underpacking is used under the plate and blanket on these presses, although the blanket is sometimes spotted or underpacked with small bits of paper to bring up low areas if it is damaged or worn. Smaller presses are usually equipped with adjusting screws or bolts which are used to regulate the pressure by moving the plate and blanket cylinders closer together or farther apart.

Attaching the Blanket to the Cylinder

The blankets for the small offset presses are generally looped or slotted at the ends and the pressman simply hooks them over pins on the blanket cylinder, drawing them taut with a set of blanket tightening screws.

The mounting of the blanket on the larger presses is slightly more involved. When working with these presses, the pressman punches holes along the front and back edges of the blanket and attaches clamp bars to these edges before he fastens the blanket around the cylinder.

The clamp bars come in two parts, and the pressman uses the top (unthreaded half) to find the positions for the holes. He places one of the unthreaded halves over the leading (front) edge of the blanket, and he places the other over the trailing (back) edge, as shown in figure 11-17.


A
A
PRINTING SURFACE OF BLANKET
DISTANCE OF DIAGONAL LINES SHOULD BE SAME
USE TOP THREADED BAR TO LAY OUT HOLES
A
A

57.227(57B)X

Figure 11-17.–Diagram showing how the clamp bars are attached to the blanket. Blanket is square if the diagonal dotted lines are of equal length. Grooves (A) are slipped under locknuts at each edge of the blanket cylinder when blanket is mounted on press.

When he is sure that the bars are parallel and aligned with the edges of the blanket, he takes a sharp pencil and traces around the holes in the bars to indicate where the blanket should be punched.

Before punching it, he measures the distance from the lower left pencil mark to the upper right and also from the lower right mark to the upper left. If both of these diagonal dimensions are the same, the blanket is "square."

He then punches the holes with a leather punch that is slightly larger than the screws to be used to hold the clamp bars in place.

Attaching the Clamp Bars

Next, he places the unthreaded half of one of the clamp bars over the leading end of the blanket, and places the threaded half of the bar under the blanket. He then runs screws through both parts of the clamp bar and the blanket.

He attaches both halves of the second clamp bar to the other end of the blanket in the same manner, measuring the diagonals of the blanket again to make sure that the clamp bars are square before he tightens the screws.

When the bars are in place, he measures the thickness of the blanket with a micrometer, to determine the amount of packing that will be needed to bring it to the recommended printing height above the bearers.

He then turns the press until the recess or gap in the blanket cylinder comes into view. (See fig. 11-18.) At this point, he inserts the clamp bar on one end of the blanket under locknuts at the lower or gripper edge of the cylinder. Next, he slips the packing in place behind the blanket, allowing it to overlap the edge of the cylinder slightly so that it will not slip when the press is running. He then moves the press (by turning a handwheel on the side or by jogging it with a button that moves it an inch at a time) to draw the blanket and packing around the cylinder. When he reaches the tail end of the cylinder (when the gap comes into view again), he slips the other blanket clamp under locknuts on a square bar called the reel. (See fig. 11-19.) He then turns the reel with a wrench; and as the reel turns, the blanket wraps around it and becomes taut. When the blanket is tight, he slips a small metal finger (pawl) in one of the teeth in the reel ratchet to keep the reel from slipping. (See fig. 11-20.)

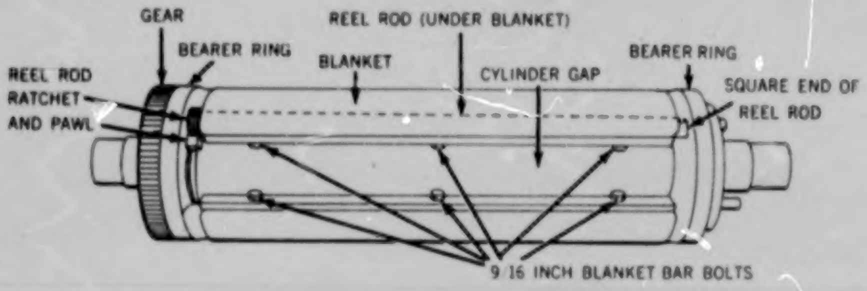
The blanket may stretch when it is first put on the press, so after he has run 200 or 300 impressions, the pressman stops the press and tightens the blanket more, if necessary. However, the blanket should not be drawn excessively taut.

Once the blanket is mounted, it need not be changed again for sometime unless it becomes damaged or worn. However, most pressmen keep 2 or 3 blankets on hand and rotate them occasionally so that each can have a resting period. This prolongs the life of the blankets.

Mounting the Plate

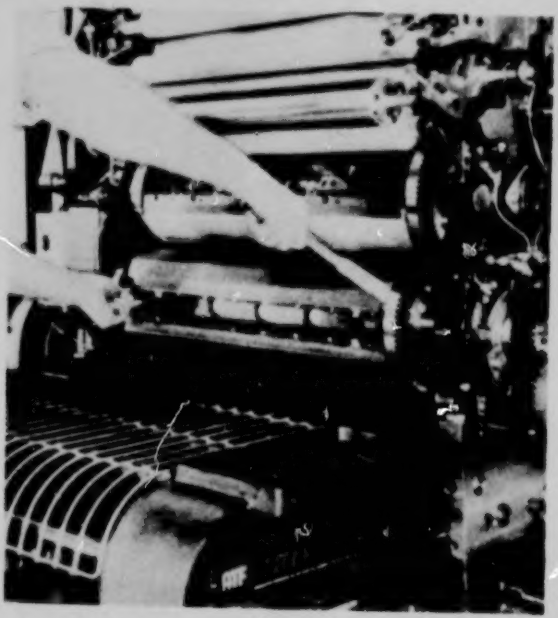
The plate is fastened around the plate cylinder with clamps, similar to those shown in figure 11-21. Before mounting the plate, the pressman wipes both the cylinder and back of the plate to make sure that the surfaces are clean, going over them with a moist rag if necessary to remove dried gum deposits and similar foreign matter. He also checks the plate for damage or defects and measures it at four or five points with a micrometer to determine the amount of underpacking it will require.

When this is done, he turns the press until the clamps come into view. He loosens these clamps, together with the plate tightening screws, and



57.228

Figure 11-18.—Diagram of the blanket cylinder. When mounting the blanket, the pressman slips the blanket clamp bars under locknuts at the gripper edge of the cylinder and on the square reel at the tail edge of the cylinder. He then turns the reel to draw the blanket taut. The pawl engages the reel ratchet to prevent the reel from slipping.



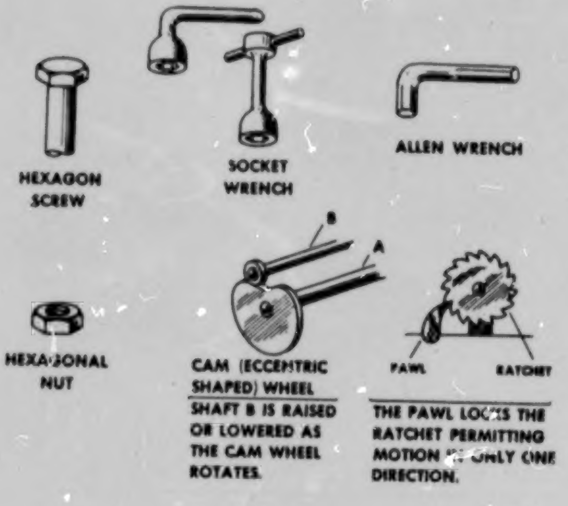
57.229X

Figure 11-19.–Tightening the reel to draw the blanket taut.

slips the top (gripper) edge of the plate into the upper set of clamps. Then he locks the clamp with a pin wrench or similar device, as shown in figure 11-21.

Next, he inserts the proper amount of packing behind the plate, allowing it to overlap the edge of the cylinder slightly so that it will not slip. Then he throws on the impression (by pushing a lever which will be described later) so that the plate and packing will be held snug as he turns the press to wrap them around the cylinder. Of course, the ink rollers would normally drop when the impression goes on, but the pressman locks them up so that they will not ink the dry plate. After all of this has been done, he moves the press slowly until the plate and packing are drawn around the cylinder and the cylinder gap appears again.

When the gap appears again, he inserts the tail edge of the plate in the lower set of clamps and locks or tightens the clamps. He then turns the plate tightening screws, shown in the illustration to draw the plate taut.


HEXAGON SCREW
SOCKET WRENCH
ALLEN WRENCH
B
A
HEXAGONAL NUT
CAM (ECCENTRIC SHAPED) WHEEL
SHAFT B IS RAISED OR LOWERED AS THE CAM WHEEL ROTATES.
PAWL
RATCHET
THE PAWL LOCKS THE RATCHET PERMITTING MOTION IN ONLY ONE DIRECTION.

1.16(57)

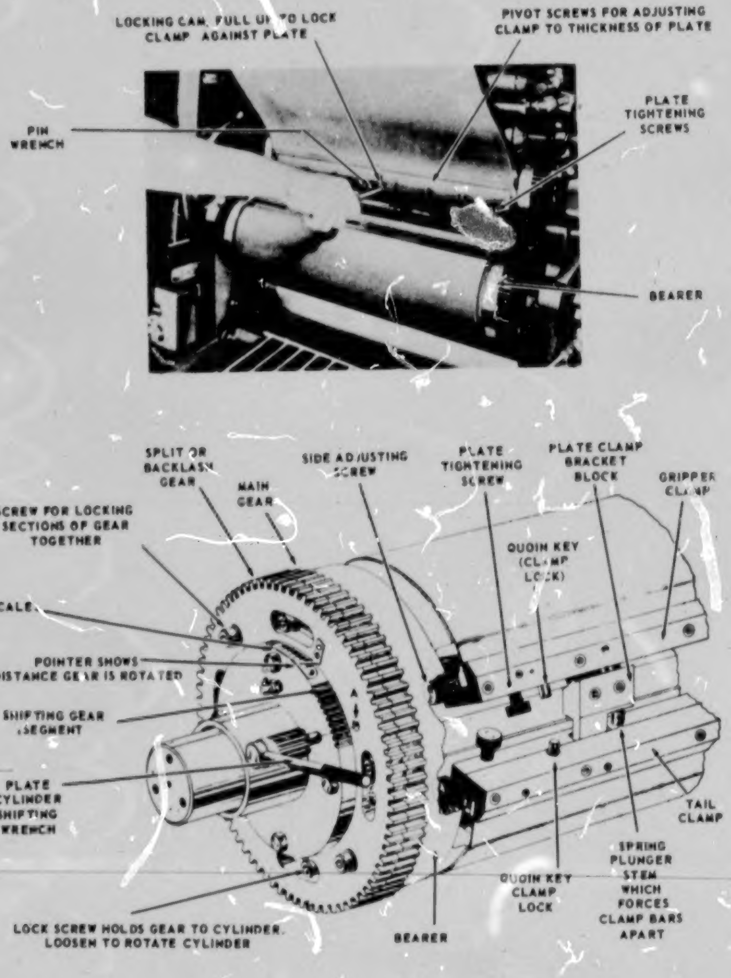
Figure 11-20.–Terms you should know.

The method of mounting the plate varies with the type of press, of course. You have already seen that it is not necessary to underpack the plate on the small offset presses. In some cases, the plates for the smaller presses are looped or slotted at the ends and the pressman simply hooks them over pins at each edge of the cylinder. Although most of the small presses are equipped with plate tightening screws, the clamps on these presses normally hold the plate taut with spring tension and the plate tightening screws are used only to provide additional tension when close-register work is being run or to make adjustments when it is necessary to twist the plate on the cylinder to compensate for a crooked image.

Positioning the Image on the Paper

Sometimes the platemaker or stripper fails to position the image properly on the plate. It may be crooked, for example, or it may be too low or too high, or slightly off center.

If the image is too far out of position, it is usually necessary to have the plate remade, but if it is only slightly off, the pressman may be able to compensate for it by making adjustments on the press.


LOCKING CAM. PULL UP TO LOCK CLAMP AGAINST PLATE
PIVOT SCREWS FOR ADJUSTING CLAMP TO THICKNESS OF PLATE
PIN WRENCH
PLATE TIGHTENING SCREWS
BEARER
SPLIT OR BACKLASH GEAR
SIDE ADJUSTING SCREW
PLATE TIGHTENING SCREW
PLATE CLAMP BRACKET BLOCK
GRIPPER CLAMP
MAIN GEAR
SCREW FOR LOCKING SECTIONS OF GEAR TOGETHER
QUOIN KEY (CLAMP LOCK)
SCALE
POINTER SHOWS DISTANCE GEAR IS ROTATED
SHIFTING GEAR SEGMENT
PLATE CYLINDER SHIFTING WRENCH
TAIL CLAMP
SPRING PLUNGER STEM WHICH FORCES CLAMP BARS APART
QUOIN KEY CLAMP LOCK
LOCK SCREW HOLDS GEAR TO CYLINDER. LOOSEN TO ROTATE CYLINDER
BEARER

57.230X

Figure 11-21.—Plate clamps vary from one type of press to another. However, they all operate on the same principle. All have a means of tightening the jaws of the clamp to grip the plate. This may be an eccentric rod or cam or quoin locks, like those shown here. The clamps are also equipped with plate tightening screws for stretching the plate taut or twisting it on the cylinder. In the case of cam-locked clamps, it is necessary for the pressman to adjust pivot screws like those shown here to set the clamp for the new thickness (if he changes to a plate of a different thickness) so that the cam will produce the correct grip on the plate. Tail clamps often have some sidewise adjustment for moving the plate sidewise or twisting it on the cylinder. The gripper-edge clamps can also be shifted sidewise on some presses. Most plate cylinders are equipped with locknuts which hold the cylinder to the gear. By loosening these nuts and rotating the cylinder (without moving the gear) the pressman can raise or lower the image on the paper.

For example, he may be able to center the image on the paper by moving the plate slightly sidewise or by changing the position of the side registering device on the feedboard.

If the image is crooked on the plate, he may be able to compensate for it by twisting the plate on the cylinder. He does this by loosening the tail edge of the plate so that it will swing free and then adjusting the plate tightening screws to move one end of the gripper clamp in farther than the other (set it at an angle). Once the plate is shifted, he retightens the tail clamp.

If the image prints too low or too high on the paper, the pressman may be able to raise or lower it by loosening locknuts which hold the gear to the cylinder and then rotating the cylinder body. This changes the position of the plate with relation to the impression cylinder grippers and thus shifts the position of the image on the paper. The method of moving the cylinder varies from one press to another. On some presses, the pressman holds the cylinder firm and turns the press to move the gear; on others, he moves the cylinder with a wrench, similar to that shown in figure 11-21 or with a set of adjusting screws located in the cylinder gap, just inside the bearers.

The pressman generally pencils in reference marks on the cylinder which he matches against a gear tooth or some other point on the press to enable him to tell how far he moves the plate. A scale is provided for this purpose on some presses.

After he has moved the cylinder the correct distance forward or backward, the pressman retightens the bolts at the end of the cylinder, washes the blanket, and then runs another sheet through the press to check the new location of the image. If further adjustments are necessary, he repeats the process just described. (He may also make minute adjustments by adjusting the front guides at the end of the feedboard.)

Impression Cylinder

The impression cylinder is a steel cylinder which forces the sheet against the blanket to transfer the image to the paper. It is sometimes called the "back" cylinder because it is usually located behind instead of directly underneath the blanket cylinder. (See fig. 11-4.) Unlike the plate and blanket cylinders, the impression cylinder is not equipped with bearers.

As you can see in figure 11-22, the gap of this cylinder contains a set of automatic grippers. These grippers grasp the sheet when it reaches the end of the feedboard and draw it around the impression cylinder which forces it against the blanket to make the impression. At the proper moment, the grippers open to release the sheet to a set of delivery grippers which carry it on to the delivery stack.

The pressman adjusts the pressure between the blanket and impression cylinder each time he changes from a thick to a considerably thinner stock and vice versa. He makes this adjustment with adjusting nuts like those shown in figure 11-22, or with a lever or knob which moves the impression cylinder to or away from the blanket.

STARTING AND STOPPING BUTTONS

Most offset presses are provided with two separate sets of buttons or switches. One is used for starting or stopping the press and the other is used for starting or stopping the vacuum pump which supplies the suction and air for separating the sheets in the feeder.

As you can see in figure 11-23, some presses also have buttons for jogging or inching the press (moving it an inch at a time) and for reversing it.

The starting and stopping buttons are generally located on a control panel on the near (operator's) side of the press. Most small presses have only 1 control panel, but the larger ones may have 2 or more sets of buttons at different points around the press. These control stations are provided so that the pressman can operate the press from various locations.

Although the press is thrown in motion when the pressman pushes the start button, the sheets do not begin feeding through until he turns on the air, and (on some presses) pushes a lever that sets the feeder in motion. When he stops the press, he first cuts off the feeder and then waits until the last sheet has fed through before he pushes the stop button.

AUTOMATIC FEEDER

The paper is loaded into the feeder on a metal or wooden platform like that shown in figure 11-24. This platform or table rises automatically as the sheets are fed into the press, keeping the height of the stack constant.

When the feeder is turned on the vacuum pump provides a stream of air through blower

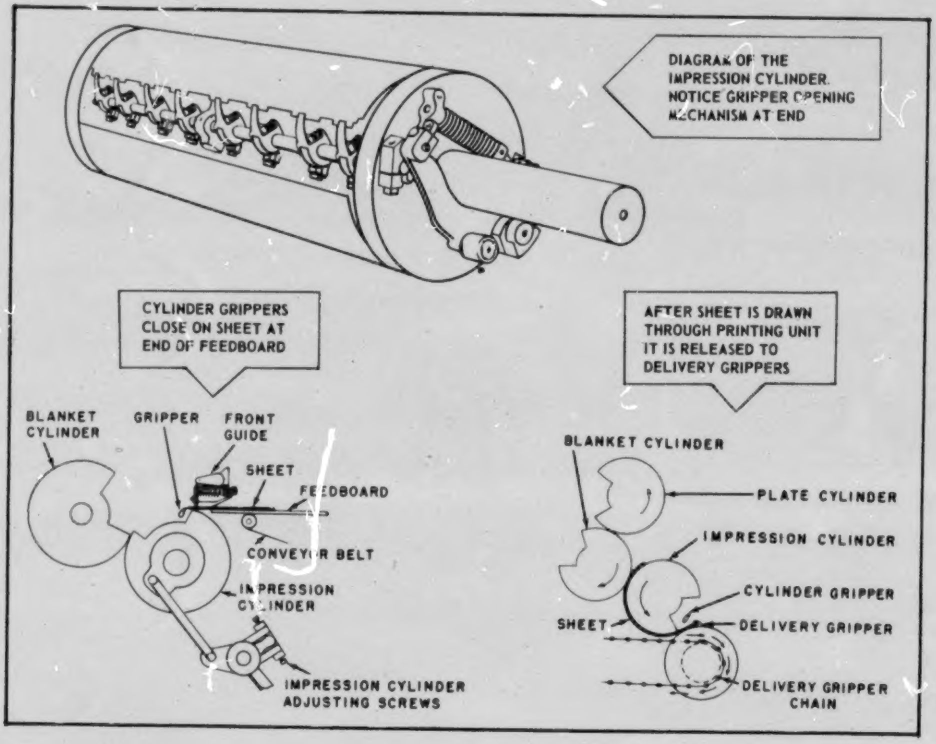
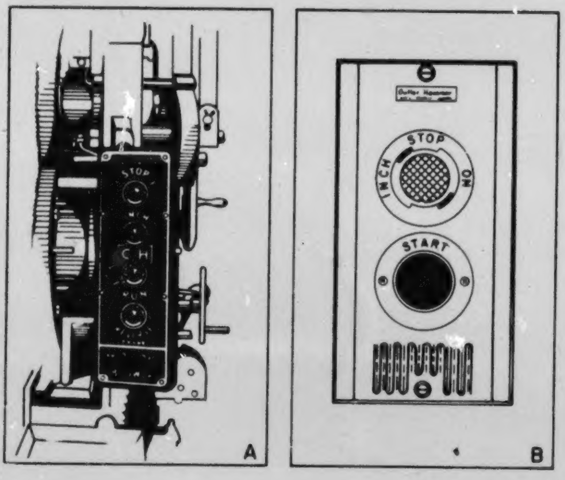


DIAGRAM OF THE IMPRESSION CYLINDER. NOTICE GRIPPER OPENING MECHANISM AT END
CYLINDER GRIPPERS CLOSE ON SHEET AT END OF FEEDBOARD
AFTER SHEET IS DRAWN THROUGH PRINTING UNIT IT IS RELEASED TO DELIVERY GRIPPERS
BLANKET CYLINDER
GRIPPER
FRONT GUIDE
SHEET
FEEDBOARD
CONVEYOR BELT
IMPRESSION CYLINDER
IMPRESSION CYLINDER ADJUSTING SCREWS
BLANKET CYLINDER
PLATE CYLINDER
IMPRESSION CYLINDER
CYLINDER GRIPPER
SHEET
DELIVERY GRIPPER
DELIVERY GRIPPER CHAIN

57.231

Figure 11-22.—The impression cylinder.


STOP
INCH
ON
START
A
B

57.232

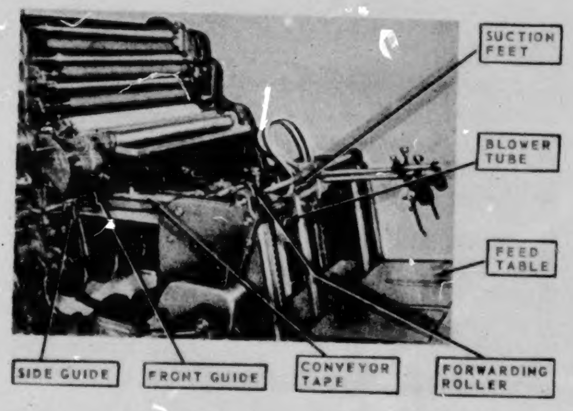
Figure 11-23.—Starting and stopping buttons found on some of the larger offset presses. Notice starting and stopping buttons for the vacuum pump at the bottom of the control panel on the left.

tubes positioned at the front (or back and sides) of the stack. This blanket of air floats the top sheets, separating them from the others in the pile.

A set of cam-operated suction feet then dip down against the front edge of the top sheet and lift it to the edge of the feedboard. At this point the suction cuts off and the sucker feet release the sheet to a pair or rubber-rimmed forwarding rollers. These rollers force the paper onto a set of moving conveyor tapes.

The conveyor tapes carry the sheet to the end of the feedboard where it is stopped by a set of pins known as the front guides. (See fig. 11-24.) A second later, a side guide (which moves back and forth as the press operates) pushes the sheet into the proper position sidewise. The action of the side and front guides squares the sheet and ensures register, since it causes all sheets to enter the printing unit in exactly the same position.

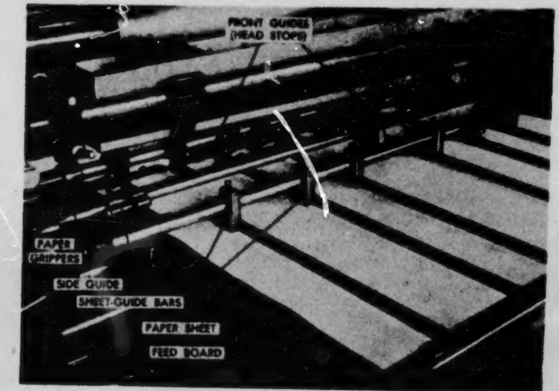
A moment after the sheet reaches the front guides, the grippers contained in the gap of the



57.233X
Figure 11-24.–Feeder end of an offset press.

impression cylinder automatically close on it and the front guides lift (or drop) to release it. (See fig. 11-25.) The sheet is then drawn around the impression cylinder and forced against the blanket to receive the impression.

On some presses, the impression goes on automatically as soon as the sheets start feeding through, and trips off automatically whenever a sheet misses. On other presses, the impression does not go on until the pressman pushes a lever (known as the pressure or impression lever) which drops the ink rollers and brings the blanket and impression cylinders into contact. As a rule, he pushes this lever just as the first sheet reaches the front guides. The impression and ink stay on thereafter as long as the sheets continue to feed through, but trip off automatically when a sheet misses. The pressman can also raise the rollers or throw off the impression by hand, of course. You will learn how this is done in succeeding chapters.



57.234
Figure 11-25.–Paper guides on one of the larger presses.

Loading the Feeder

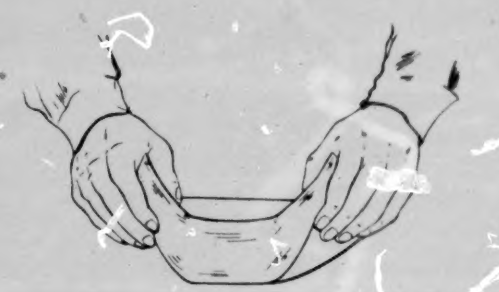
You have already seen that the feed table rises automatically as the sheets are fed into the press so that the pile stays at a constant height. The pressman can also raise or lower the table by hand by turning a crank on the side of the press. (See fig. 11-24.) He lowers the platform by hand when he loads the feeder, and he raises it again to operating height before starting the run. The feed table would work up automatically, of course, but it is quicker to raise it by hand.

The paper is generally loaded onto the feed table a fraction of an inch off center toward the side guide. This off-center position allows for the action of the guide which pushes each sheet into the proper position (sidewise) as the paper reaches the end of the feedboard.

Once the feed table is lowered, the pressman moves two metal bars, known as piling bars, to positions along a scale at the front of the feed table which correspond to the width of the stock to be run. When set in these positions, the bars will be at the front corners of the paper stack, and they will steady the paper as it is fed into the press and also serve as a guide to the pressman in loading the stock.

If the feed table is not equipped with a scale for positioning the piling bars, the pressman may crease a piece of the stock to find its center, and place it on the feed table in a slightly off-center position. He can then position the bars by moving them up to the edges of the sheet. (The feed table may be marked to show its center, but if it is not, he must approximate the location of the sheet.)

Once the piling bars are set, the pressman loads the stock onto the feed table. The stock is generally loaded in small stacks, called lifts, each about 1 1/2 or 2 inches in thickness. The pressman jogs each lift, fanning or ruffling the stock to introduce a blanket of air between the sheets before he loads it into the press. (See fig. 11-26.)



57.235
Figure 11-26.—Fanning a lift of paper to introduce a blanket of air between the sheets.

The amount of paper that he loads on the feed table depends on the size of the run and the type of press. Most presses will take a stack around 20 inches high. If the press will not take enough paper for a complete run, the pressman reloads the feeder when the first stack is exhausted.

Once the pressman has loaded the feed table and raised it until the top of the stack is at the proper height (usually 1/4 of an inch below the sucker feet when they are all the way down), he then positions short metal fingers against the back of the pile. These fingers steady the sheets as they are floated by the blast (air from the vacuum pump) and prevent them from jumping as they are picked up by the sucker feet.

The feeder setup varies of course, with the make and construction of the press. You will learn how to set up the feeders on individual presses in the succeeding chapters of this book.

Pile Height Governor

The pile height governor, shown in figure 11-27, controls the speed of elevation of the feed table, and you can adjust it to make the stack run higher or lower. As the paper is fed into the press, this governor rides lower and lower until it finally allows a pawl to engage and turn an elevating ratchet which moves the feed table up one notch. This elevating mechanism varies from one type of press to another, but the principle is the same on all presses.

Separator Fingers

Most offset presses are equipped with a set of separator fingers similar to the ones shown in figure 11-27. These fingers are simply steel wires or tongues which hook over the stack and hold down the edge of the top sheet as it is floated by the blast. When the suckers pull the top sheet from the grip of the separator fingers, the fingers drop against the next sheet in the stack to prevent it from being picked up, too.

The separator fingers are located at the front of the stack on some presses, as shown in figure 11-27. On others, they are found at the back or sides of the pile. (See fig. 11-28.)

If the separator fingers drag too heavily against the paper they may interfere with the action of the sucker feet; and if the tension is too light, they may fail to separate the sheets properly. The pressman can adjust them, as necessary, for proper contact with the stock.

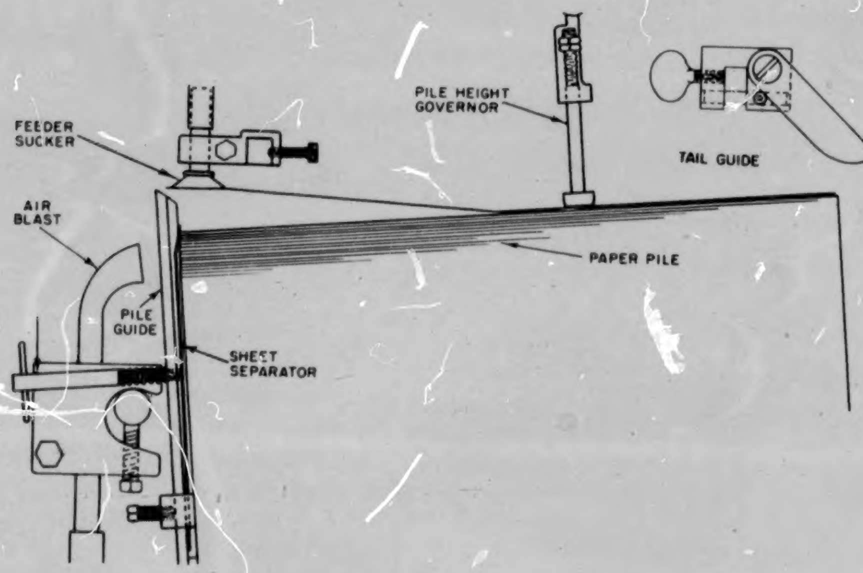
Suction and Blast Adjustments

Incorrect adjustment of suction and blast may also cause feeding difficulties. For example, if there is insufficient suction, the sucker feet may fail to pick up the sheet; and if there is too much, they may pick up two sheets at a time, particularly if the stock is thin. The pressman regulates the amount of suction and blast with adjusting screws located at the vacuum pump or on the air lines at the side of the press. The blast is ordinarily set to float only the 2 or 3 top sheets in the pile.

Pressmen often slip bell-shaped rubber tips over the regular metal sucker feet to increase their pulling power when they are running heavy or bulky stocks.

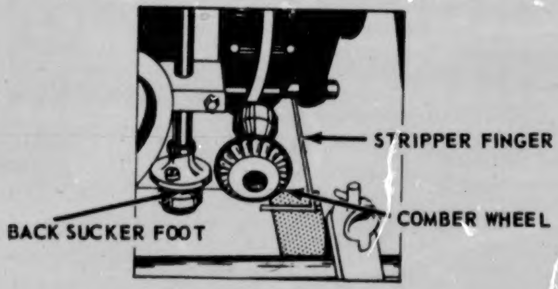
Flap Shaft

Some presses are equipped with a shaft and two metal plates at the end of the feed table. When the press is running the shaft turns to move the plates (called flaps) to or away from the stack. As the flaps move against the stack,



57.236X

Figure 11-27.—Sheet feeding controls. Methods of picking up the top sheet and forwarding it to the feedboard vary from one type of press to another. On the press diagrammed here, the top sheet is floated by air from the blast pipes at the front of the pile. The sucker feet then dip down and catch the top sheet and lift it to the edge of the feedboard. Other presses are equipped with separating units, like that shown in figure 11-28.



57.237

Figure 11-28.—Separating unit used at back corners of the pile on some presses. When the feeder is in operation, the comber wheels buckle the back corners of the top sheet just enough to permit the back sucker feet to contact it. The back suckers lift the back edge of the paper and two blast feet then swing in between the lifted edge and the pile and supply a cushion of air that floats the top sheet, separating it for its entire length from the other sheets in the stack. At the front of the pile, forwarding sucker feet then catch the sheet and move it up to the edge of the feedboard.

they job the front of the pile to keep the sheets even, and as they move toward the delivery end of the press, they tilt forward to form a ramp which guides the sheet onto the feedboard.

Forwarding Rollers

The sucker feet carry the sheet to the edge of the feedboard and release it to a pair of rubber-rimmed forwarding rollers (sometimes called pull-in wheels). These rollers are usually set over the conveyor tapes. They raise and lower against a bottom roller which rotates as the press runs to force the paper onto the feedboard. If the pressure is not the same on both of the rubber-rimmed rollers, the sheets will feed crooked and the pressman must adjust the tension on one of them. The pressman usually raises them by hand to keep the rubber rims from developing flats when the press is shut down at night.

Caliper

Since double sheets may jam the press or damage the blanket, each press is equipped with a safety device, known as the multiple-sheet detector or caliper. (It may also be called the two-sheet choke.) The caliper is generally centered on a bar extending across the feedboard just past the forwarding rollers. (See fig. 11-29.) By turning an adjusting screw, the pressman can set this device to clear 1 sheet but to bind when 2 sheets feed through.

When the caliper binds on the smaller presses (duplicators), it actuates a mechanism which automatically throws the two sheets into a metal pan below the feedboard. On the larger presses, the caliper trips off the press or holds the sheets until the pressman can remove them by hand.

Conveyor Tapes

As you can see in figure 11-29, the conveyor tapes are endless fabric belts which are threaded over a roller at each end of the feedboard. When the press is in operation the rollers turn and the tapes travel down the feedboard and then back under it in one continuous operation. Individual pulleys (under the feedboard) keep the tapes taut.

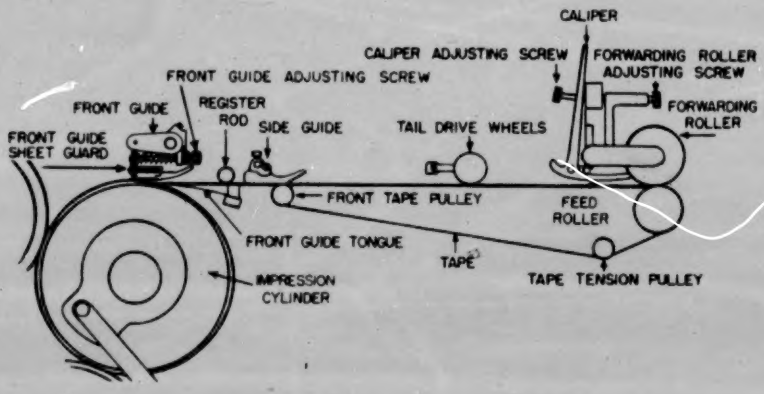
Sheet Controls

Besides the forwarding rollers, which force the sheet onto the moving conveyor tapes, certain controls are required to prevent the sheets from curling or running wild as they are carried down the feedboard. Most presses use metal bars or rods for this purpose. (See fig. 11-25.) These metal strips, which extend the full length of the feedboard, are generally placed over the conveyor tapes. There must be a slight clearance between the strips and tapes of course, as a dragging action will cause wear on the tapes and interfere with the movement of the paper.

On most presses, these holddown strips are adjustable sidewise and the pressman can set them to accommodate any width of stock. He may also be able to raise them as a unit when removing wrinkled sheets from the caliper or feedboard.

In addition to these rods, pressmen also use detachable wheels and brushes to help control the sheet. (See fig. 11-29.) The wheels are generally attached to one of the holddown strips, and they are positioned over the conveyor tapes so that they will rest just off the tail end of the paper when the sheet reaches the front guides. In this position they will keep the sheet from bouncing away from the guides, yet will not interfere with the movement of the sheet by the side guide.

The brushes are also attached to the holddown rods, and they are set half on and half off the tail edge of the sheet to prevent the paper from bouncing away as it strikes the guides.


CALIPER
CALIPER ADJUSTING SCREW
FORWARDING ROLLER ADJUSTING SCREW
FRONT GUIDE ADJUSTING SCREW
FRONT GUIDE
REGISTER ROD
FORWARDING ROLLER
SIDE GUIDE
TAIL DRIVE WHEELS
FRONT GUIDE SHEET GUARD
FRONT TAPE PULLEY
FEED ROLLER
FRONT GUIDE TONGUE
TAPE
TAPE TENSION PULLEY
IMPRESSION CYLINDER

57.238X

Figure 11-29.—Feedboard controls.

Front Guides

The front guides vary with the make of the press. But in general, they consist of two or more metal posts or pins which stop the sheet, holding it temporarily on the feedboard while the side guides moves it into position sidewise. (See fig. 11-29.)

As soon as this has been accomplished, the front guides either rise above or drop below the surface of the feedboard to clear the sheet as it is caught by the impression cylinder grippers and pulled into the printing unit.

The action of the front guides is controlled by a cam attached to the end of one of the press cylinders. As the cylinder rotates, this cam operates a lever which rotates the shaft to which the guides are attached, forcing them up or down. When necessary, the pressman can loosen the lock screws and move this cam forward or backward so that the front guides will be timed to rise and lower at the proper moment.

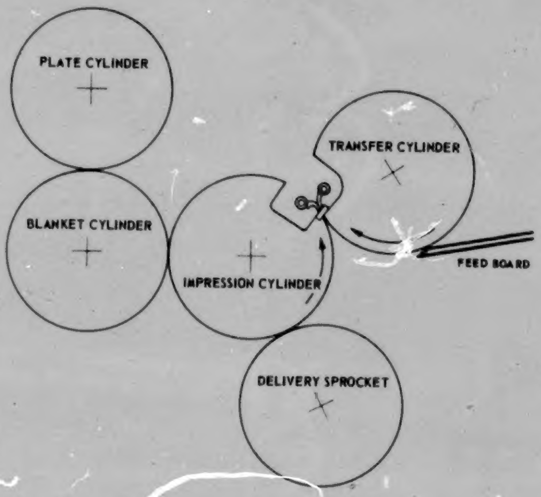
Most presses have only 2 front guides, but a few presses have 4. The pressman can move the guides on the larger presses sidewise to accommodate different widths of stock, and he can adjust them (forward and backward) to regulate the gripper bite on the paper. (When he moves the front guide stop toward the cylinder, the stock travels farther into the grippers and the image prints lower on the paper; and when he moves the stop in the other direction, the grippers have less bite on the stock and there is less margin or white space at the top of the sheet.) If the image is slightly crooked on the plate, he is sometimes able to compensate for it by setting one of the guides ahead of the other so that the paper will feed a trifle crooked.

As you will see in succeeding chapters of this book, some presses do not have front guides, like those discussed here. However, they are equipped with registering devices which serve the same purpose as the front guides.

Insertion Devices

On some presses, the sheet is delivered to the end of the feedboard–within reach of the impression cylinder grippers. On other presses, a special insertion device is required to move the sheet into the cylinder grippers after it reaches the front guides. For example, the Multilith is equipped with a roller which drops on the sheet (just as the front guides recede) and forces it into the grippers. Larger presses often are equipped with a feed or transfer cylinder at the end of the feedboard. Although it is called a cylinder it actually consists of a series of disks attached to a shaft and provided with grippers for receiving the paper. These grippers grasp the edge of the sheet at the edge of the feedboard and transfer it to the impression cylinder grippers, as shown in figure 11-30.

The swing gripper, shown in figure 11-31, is another insertion device which is found on some types of presses.

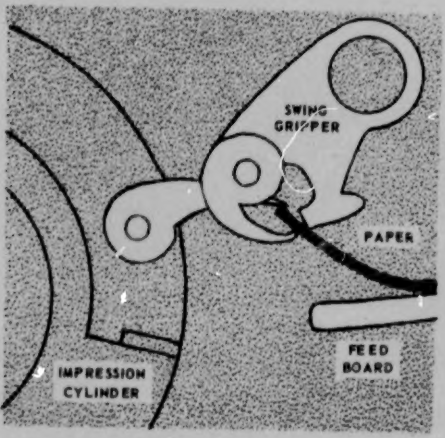


57.239X

Figure 11-30.—Diagram showing how the transfer cylinder catches the sheet at the end of the feedboard and transfers it to the impression cylinder grippers.

Side Guides

The side guide is generally attached to a cam-operated bar, which moves back and forth sidewise when the press is running. As the paper reaches the end of the feedboard, the side guide moves in and pushes the sheet sidewise to its registering position. The smaller (duplicator) presses generally have only one side guide, but the larger presses have two–one on each side of the feedboard.



57.240
Figure 11-31.—Swing gripper insertion device. The swing grippers pick up the sheet at the front guides and accelerate it to cylinder speed before transferring it to the impression cylinder grippers.

Of course, only one of these guides is used at a time. The other is either locked out of operation or it is moved to the edge of the feedboard where it will not interfere with the feeding of the stock. The pressman uses the guide on the near (operator's) side for the ordinary run of work, but he may use the other side guide when he is backing up a job so that the paper will be jogged from the same edge when it is run through the press the second time.

The method of setting the side guide to the size of sheet being run varies from one press to another. On some presses, it is simply moved to the proper place along a scale on the feedboard. On others, the pressman inches the press to deliver a sheet down the feedboard to the front guides. He then moves the sheet 1/4 of an inch sidewise (away from the side guide to be used). After this, he turns the press until the guide is at the end of its thrust toward the center of the feedboard and then moves it up against the sheet and locks it in place.

This setting will cause the guide to push each sheet approximately 1/4 of an inch sidewise and thus ensure proper registration, since the stock is loaded onto the feed table in a slightly off-center position.

The first setting is only a preliminary setting, of course. After he prints a trial sheet and examines the position of the image on the paper, the pressman may need to make further adjustments to center the printing on the sheet.

The side guides do not work alike on all presses, of course. Some side guides pull—instead of push—the paper sidewise into register.

Sheet Flattening Bar

Many of the larger presses are equipped with a metal rod known as the sheet flattening bar which drops against the sheet just after it reaches the front guides and steadies the paper as the side guide moves it into register. Smaller presses are not equipped with a sheet flattening bar.

Sheet Detector Finger

You have just seen that on some of the larger presses, it is necessary for the pressman to push a lever to bring the cylinders into contact (throw on the impression) so that the image will print. The ink rollers go on simultaneously with the impression on most of these presses. The impression and ink stay on automatically thereafter unless the operator throws them off by hand or unless a sheet jams or fails to feed through the press.

When a sheet fails to feed through, a small metal finger at the end of the feedboard drops into a groove in a cog and jams it, actuating a mechanism that trips off the impression and ink. If it were not for this detector finger, the blanket would print on the impression cylinder itself. Then unless the pressman stopped the press and washed the cylinder, the next sheets that came through would be offset or printed on the back as well as the front.

(The detector finger functions differently on certain types of presses, as you will see in future chapters.)

Slowdown Mechanism

If the sheets travel down the feedboard too fast, they may be damaged when they strike the front guides and cause poor registration. To prevent this, a slowdown cam is provided on some of the larger presses to slow the conveyor tapes briefly, just before the sheet reaches the guides. Slowdown fingers attached to cam-operated arms are also used for this purpose. As these arms move forward, they rise slightly so that the fingers protrude through grooves in the feedboard. The fingers contact the sheet just before it reaches the guides and move forward with it. After the sheet reaches the front guides, the arms drop so that the fingers clear the sheet as they swing back to their forward position.

IMPRESSION CYLINDER GRIPPERS

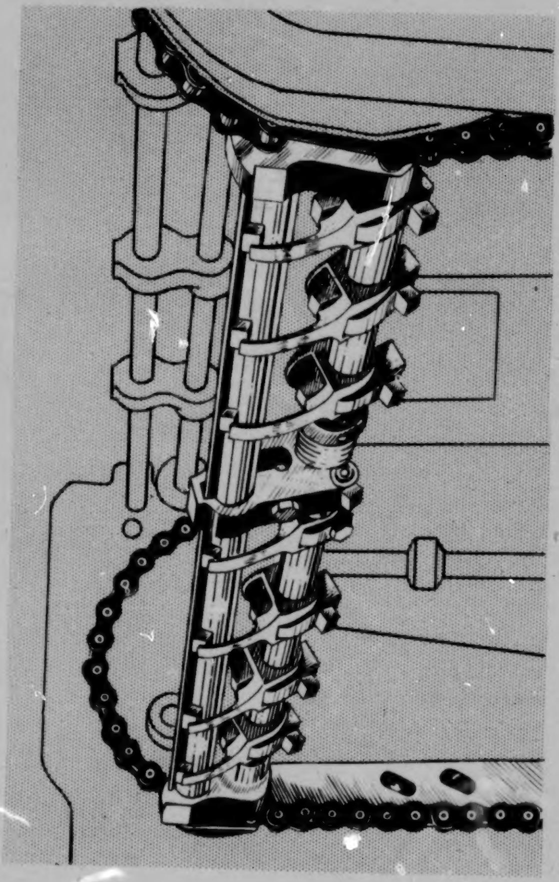
During part of the revolution, the impression cylinder grippers are held (closed) against the edge of the cylinder by spring tension. (See fig. 11-22.) However, as the cylinder revolves, a pin extending from the press frame engages a tumbler mechanism at the end of the cylinder, causing the tumbler to rotate and turn the shaft to which the grippers are attached. As the shaft turns, the grippers open to receive the sheet. The grippers close again (on the edge of the sheet) as soon as the tumbler passes the pin.

The paper is then drawn into the printing unit (between the blanket and impression cylinder). As the sheet emerges from between these two cylinders, another pin causes the impression cylinder grippers to open again to release it. As the impression grippers release it the sheet is caught by a set of delivery grippers, like those shown in figure 11-32, and carried down in a clockwise direction around a series of evenly-spaced disks (sometimes called the skeleton or delivery cylinder) and out over the delivery platform. (See figs. 11-4 and 11-33.)

(The tumbling device just described is generally found on presses which deliver the sheets within reach of the grippers, but presses which employ special insertion devices at the end of the feedboard often have cam-operated grippers.)

DELIVERY UNIT

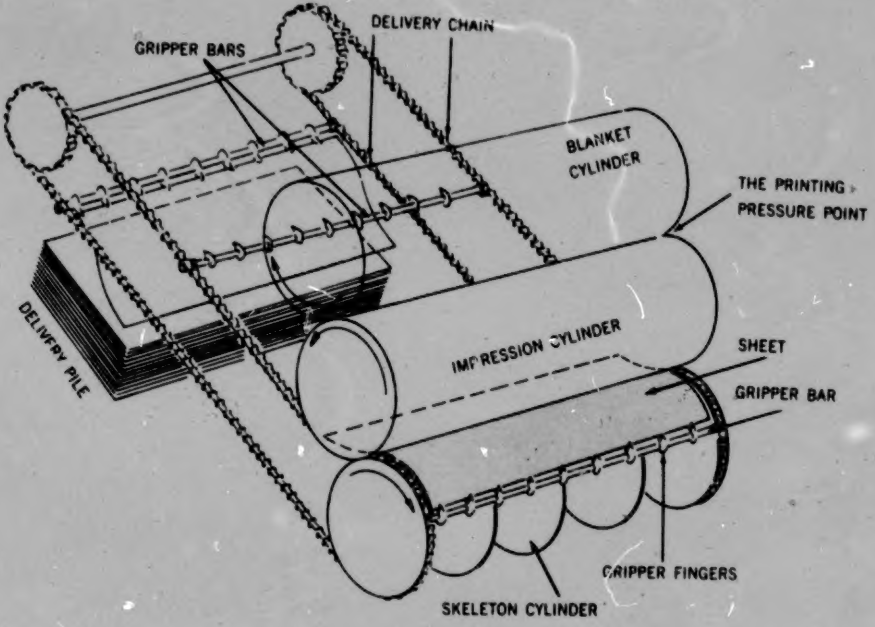
As you can see in figure 11-34, the delivery grippers consist of a series of small metal fingers attached to a bar which is extended between two continuous chains. There may be two or more sets of these grippers, depending on the speed of the press and the distance between the delivery platform and the impression cylinder. They are spaced at regular intervals along the chains so that one set of grippers is receiving a sheet while another set is delivering the preceding one.



57.241

Figure 11-32.—Delivery grippers.

The grippers are ordinarily held closed by spring pressure, but as the chains carry them toward the impression cylinder, they pass over a cam which forces them to open long enough to grasp the edge of the sheet. They then carry the sheet around the skeleton cylinder and out to



57.242

Figure 11-33.—The delivery (skelton) cylinder consists essentially of a pair of sprocket wheels which drive the delivery gripper chains and a series of evenly-spaced disks or segments which help control the sheet as it is carried from the printing unit to the delivery platform.

the end of the press where a trip cam forces them to open again to release it to the delivery platform. Stripper fingers, like those shown in figure 11-34 are provided to strip the sheet from the grasp of the delivery grippers and direct it down to the delivery stack. The front stops, shown in the same illustration, prevent the sheet from flying off the platform when it is released. Figure 11-4 shows the route of the sheet from the printing unit to the delivery pile.

(Some of the smaller presses have no delivery grippers. They are equipped with a special ejection mechanism, which you will learn about in succeeding chapters of this book.)

Delivery Platform

On most of the larger presses the delivery platform is built to lower automatically as the sheets are delivered, and the pressman can set it to operate at any suitable speed. Many of the smaller presses, are not equipped with an automatic receding platform, however, and the operator must remove the sheets from the paper receiver at regular intervals to keep the stack from getting too high.

Automatic Joggers

Large presses have automatic joggers, like those shown in figure 11-34. These joggers are simply metal plates which move back and forth when the press is in operation and keep the stack even by pushing each sheet in place as it is released from the delivery grippers. The operator positions these joggers at the sides and back of the stack as shown in the illustration.

Most of the smaller presses are not equipped with automatic joggers. They have stationary guides which may be adjusted to accommodate any size of sheet.

PRESS OPERATION

By now you should have a fair idea of the main divisions of the offset press and the functions of each. Although the operating parts discussed here vary from press to press, they are similar enough that once you are acquainted with the fundamentals, you should be able to understand the operation of any offset press.

Since there is a similarity in the operation of most presses, the following discussion will give you an idea of the sequence of operations involved in setting up and running a job on these machines.

Before Starting the Press

As a rule, the operator oils the press at the beginning of the day, and he cleans and greases it at regular intervals.

Before starting a run, he takes ink from a can and works it out with a palette knife on a slab of stone or a piece of glass until it is rather fluid. If driers or other modifiers are required, he adds them at this point.

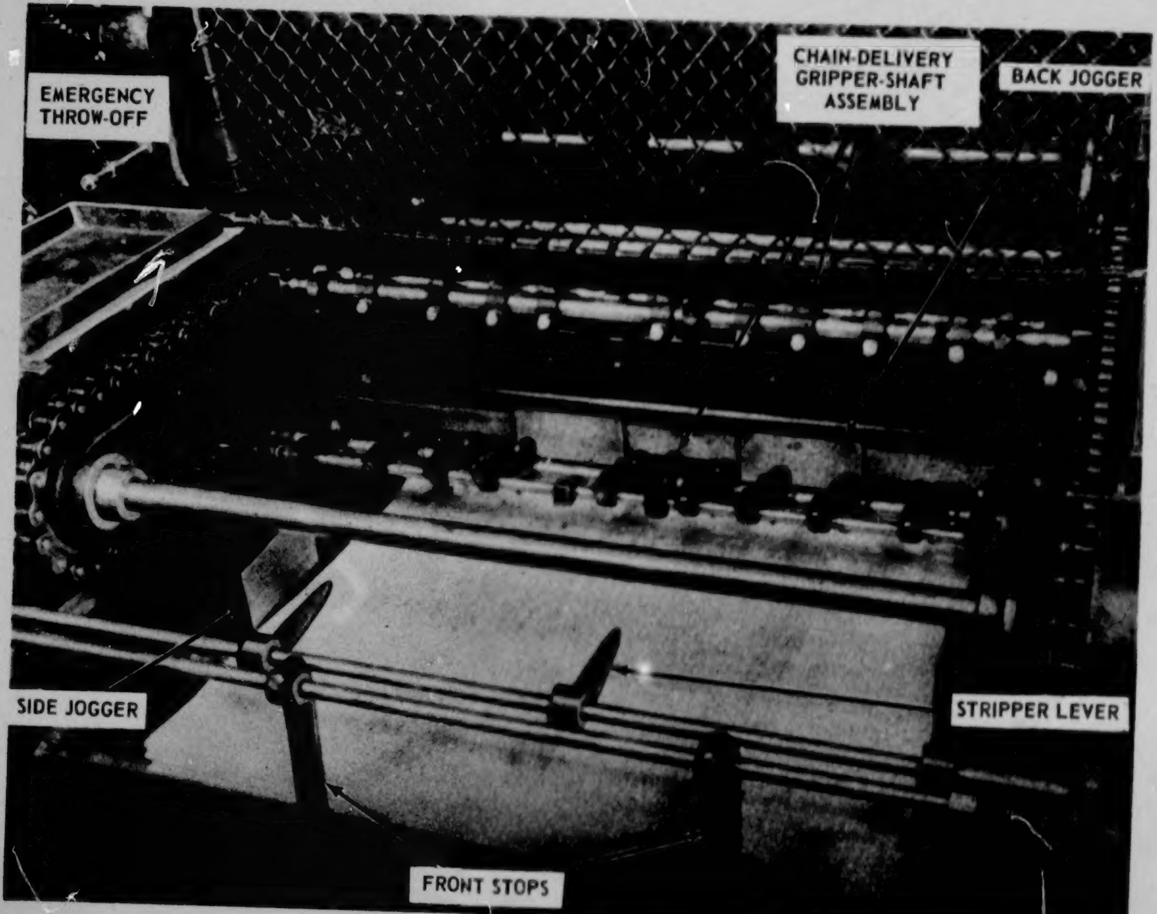


Figure 11-34.—The delivery platform is set to lower automatically as the printed sheets are delivered. Detachable dollies are used in place of the platform on many presses. As sheets are delivered, the dolly gradually lowers until it reaches the floor. It is then wheeled away and another dolly is inserted in its place. 57.243

As soon as he has worked out the ink, he distributes it evenly in the fountain. He then mixes the water and fountain etch in the correct proportions and fills the water fountain to the proper level. After this, he runs the press for a few minutes to allow the ink and water to distribute over the rollers.

At the beginning of the day, some pressmen squeeze a wet sponge above the rollers, moving it back and forth to distribute the water evenly. They repeat this process 4 or 5 times until the rollers are sufficiently damp. If the same sponge is used for the same number of times, fairly consistent results can be obtained. With a little experience, the pressman can tell when the ink and water distribution is correct.

Mounting the Plate

The pressman next takes the plate to be run, measures it with a micrometer to determine the amount of packing required, and mounts it on the plate cylinder. It is unnecessary to change the blanket each day. Once it has been mounted, no further adjustments will be required until it becomes damaged or worn.

Setting the Feeder

He next sets the piling bars and jogs the paper and loads it onto the feed table, placing it a fraction of an inch off center. After this, he raises the stack to operating height. He then sets the metal fingers against the back of the stack.

To keep from spoiling fresh stock, the pressman generally interleaves the top sheets of his paper stack with 30 to 40 sheets of waste paper which he uses during the make-ready operation.

If necessary he adjusts the tension on the wheels which control the sheet as it is carried down the feedboard, and sets the caliper so that it will allow 1 sheet to pass onto the feedboard, but will bind if 2 sheets are fed into the press. He then makes a preliminary setting of the side guide and other operating parts of the feeder and runs one sheet through the press, stopping it just before the sheet is released by the delivery grippers. At this point, he sets the joggers and the delivery platform to conform to the size of the sheet.

Printing a Trial Sheet

When all is set, he washes the plate with a sponge and water and starts the press rotating at a slow speed. He then moves the dampener rollers into contact with the plate and lets the press run for about 30 seconds before he lowers the inking rollers. After about 1 minute, he stops the press, sponges the plate with water, and checks it to see if all areas are properly inked, and if the nonprinting areas are free from scum and tint.

If the nonprinting areas have picked up ink, he cleans the plate with a sponge dipped in the fountain etch and then adjusts the fountain for a more adequate supply of water.

Local scum that cannot be removed by sponging with water must be carefully etched away with concentrated fountain etch and a small sponge. After rhe scum is removed, the pressman sponges the etch off with clear water.

He then starts the press again, throwing on the water and ink, as before. This time, he turns on the vacuum pump and starts the sheets feeding through. As the first sheet reaches the front guides, he pushes a pressure lever to throw on the impression. (This operation varies, according to the type of press.) He allows 4 or 5 waste sheets and 1 clean sheet to feed through the press. Then he stops the feeder but allows the press to continue to run while he examines the printed sheet for position, color, errors, and defects.

Making Corrections

After checking the print, he adjusts the press as required to provide the proper ink distribution. He may also adjust the tension between the blanket and impression cylinders.

It will seldom be necessary for the pressman to correct the plate itself, but if such corrections are necessary, he must stop the press, apply a thin coating of gum arabic to the plate and fan it dry. He can then add fine lines or other detail by scratching through the gum with a sharp needle or scraper, and rubbing the engraved lines with an inky rag.

To fill in broken rules or lettering, he generally sponges the plate locally with water to remove the gum. He then fans it dry and adds the corrections with a hard lead pencil or litho crayon. After this, he applies plate etch to the exposed areas, wipes them dry and then gums the plate and fans it dry again.

He can remove unwanted marks with a snakeslip or red rubber eraser. He applies concentrated plate etch locally to desensitize the exposed metal, then sponges with clean water.

Positioning the Image on the Sheet

The position of the image on the sheet depends on the location of the image on the plate, the position of the plate on the cylinder, and the feeder setup.

Straightening the Image

If the image prints slightly crooked on the paper, the pressman may be able to straighten it by setting one of the front guides slightly ahead of the other in the manner already discussed.

If excessive movement is required, however, he must shift the plate on the cylinder. On some presses, he can shift the plate by loosening the lock and tension screws at the tail edge of the cylinder and adjusting these screws on the opposite edge. Other presses require that the plate clamps be loosened and that the plate be shifted manually. The pressman must never force the plate during these operations, of course, as too much tension may tear it or stretch it out of shape.

Centering the Image Sidewise

If the image is slightly off center sidewise, he generally adjusts it by moving the side guide or with side adjusting screws in the plate clamps. If the adjustment is very large, it may also be necessary for him to move the feeder pile and the delivery joggers to keep them all in alignment.

Raising or Lowering the Image

If it is necessary to raise or lower the image on the paper, the pressman may move the front guides or he may shift the body of the plate cylinder. Since the plate is attached to this section, moving it changes the location of the image on the paper.

You have already seen how the pressman releases the cylinder body from the gear by loosening bolts at the end of the cylinder and then moves the cylinder forward or backward.

Final Preparation

If the plate has been moved during makeready operations the pressman always cleans the blanket with blanket wash. If the blanket appears tacky after washing, he dusts it with talcum powder and wipes the excess powder off with a rag. Then he sets the counter (a device which keeps a running record of the number of impressions made), sponges the plate with water, and starts production.

Examination During the Run

During the run, he examines the work at regular intervals, removing a sheet from the delivery pile about every 60 to 100 impressions. He also watches ink distribution and register. He adjusts the ink fountain and water until the proper balance is obtained.

It is sometimes necessary to keep a close check on the register of the job, as in the case of two-color work. In many cases, the stripper cuts slits in the negative layout so that small lines will print on the plate in such a position that they will run off the edges of the paper. If such lines are provided, the pressman can use them in checking registration when the press is running.

If such marks are not provided, the pressman generally pencils them in on the plate. Once he has established his position, he takes one of the printed sheets and matches it against the image on the plate. Then he makes 1 or 2 short marks on the plate at the edges of the sheet. When he starts the press, these marks will take ink and print lightly in the extreme edges of the paper. And although they will not be particularly noticeable on a single sheet of paper, they will show up readily when several sheets are stacked together. They will enable the pressman to check the register by simply looking at the printed line along the edge of the stack.

Clean-up Operations

After the run is completed, the pressman stops the press; gums the plate, and fans it dry. He next transfers the plate to a table and washes the image out with solvent. After this, he rubs a thin coating of asphaltum into the image areas and stores the plate in a cool, dry place for future use.

He then washes the blanket with blanket wash or a suitable solvent and prepares the press for the next plate.

At the end of the day, he generally removes all ink from the fountain and cleans the fountain, rollers, and blanket. Unless these parts are cleaned thoroughly, the ink will dry hard and cause future trouble. Roller wash or other suitable solvent may be used for this purpose.

Flammable solvents should not be used aboard ship. If they are used in shore establishments, the pressman must see that there is adequate ventilation and he must keep away from open flames. Ink and solvent-soaked rags are generally kept in safety cans and these cans are emptied daily to prevent spontaneous combustion.

The pressman often washes the blanket with both blanket wash and water to remove all ink and gum deposits. He also cleans the cloth-covered dampening rollers with water, and (when they are extremely dirty) with a special cleaning solution. He changes the roller covers when they get too dirty to do their work effectively. You have already seen how this is done.

TYPES OF PRESSES

Aboard ship, you are likely to come across the 23" × 36" and the 19" × 25" Harris presses, the 14" × 20" (Chief 20 or Chief 20-A) press, manufactured by the American Type Founders; the A. B. Dick, Models 350 and 385; the Miehle-Goss-Dexter, Model 22-C; and the Multilith, Model 1250 manufactured by the Addressograph-Multigraph Company.

This list is not all-inclusive. There are many other good offset presses put out by several different companies and you may come across some of these presses at shore stations. Since it would be impossible to cover all types of presses in a manual such as this one, the discussion in this text is limited to those presses which you are most likely to come across in your work aboard ship.

SAFETY HABITS AROUND THE OFFSET PRESS

Accidents are the result of doing things the wrong way. Safety practices and procedures should become a habit from constant observance of safe procedures.

First aid should be obtained for all injuries, no matter how small. This serves as a guard against infection and prevents delay in healing.

Cleanliness

Sloppy cleaning habits and disregard for putting things in their proper places can lead to many accidents. The following is a check off list for general use. You should add items which may be of value in your own shop.

1. Are oil drip pans and oil troughs empty or packed with cotton to prevent lube oil from spreading over the deck?
2. Are safety containers for solvents available and in use?
3. Are metal rag containers being used?
4. Are waste containers for paper provided and used?
5. Are there no ink cans on floor or platforms?
6. Are no tools left on walkways?
7. Are there no items of wearing apparel hanging on the control stations or press frame?
8. Are rollers properly racked so as not to come loose?
9. Are the floor, platform, and steps free of grease and oils?
10. Are areas around presses free from boxes and litter on the floor?

Safety in Press Operation

The correct way is the only safe way in press operation. Personal safety factors, as well as mechanical and general shop conditions should be considered. Check your procedures to see that you observe the following practices:

1. Shirts must be tucked in trousers at all times with sleeves rolled up or buttoned cuffs to insure that material cannot be caught in press gears or rollers and on projecting levers. Trousers must be cuffless and not baggy so as to snag on protrusions. If aprons are worn they must fit snug and tied lightly so that if they are caught on moving parts the apron will come off without dragging the wearer into the machinery.
2. The desire to keep ones hands and fingers intact should take preference over the wearing of jewelry.
3. Leaning against presses that are running or resting hands near moving parts invites disaster.
4. Do not carry tools in pockets because they may drop into moving machinery or cause someone to slip on them if dropped on the deck.
5. Proper sized tools must be used when making adjustments so as not to round off bolt heads and damage equipment.
6. Unauthorized operation of a press that you are not familiar with is dangerous. Do not attempt to operate a press without being instructed in complete detail.
7. Do not attempt to oil any press while it is running. Always stop the press to clear jams, to oil, to set and to make adjustments, to make repairs, or to clean. Always stop the press to pick off hickies.
8. Replace all guards before press is started.

Guards

Offset presses have adequate guards included in their design. Sometimes these guards are removed or lost and never replaced. Some operators become very careless after operating the same press day after day, and do not use these guards. Needless to say, this is a very dangerous way of doing a job. Any piece of fast moving machinery, such as a printing press, presents many ways to be caught and pulled into the works. Always check the safety guards on your press and be sure they are in place before starting the press. Some points to check are listed below:

1. In-running cylinders and rollers.
2. Between the blanket cylinder and the plate cylinder.
3. Gears at the edge of plate and blanket cylinder.
4. Chain delivery.
5. In addition you should check your particular press for all exposed gears and cylinders for places that could grab an offered finger or piece of clothing.

Press Controls

A press operator should acquaint himself with all operating controls and the exact placement of the switch stations before starting any press. He should also know the location of the master switch, the fuse box, and the speed control adjustment.

Making sure everyone is in the clear before pushing the run button can save a lot of pain and suffering for an unsuspecting person that may be leaning on the machine out of your line of sight. Always make sure the safe button is locked in when you are working on a standing press while cleaning or adjusting or repairing it.

Make sure you hit the correct button when inching the press or reversing inch. When removing or replacing a plate or blanket this may mean the difference between a short or normal finger.

Washing Operations

You should always use caution when washing up the ink fountain, or cleaning blankets, plates, rollers, and parts of the press. The following are precautions which should be followed.

1. Do not smoke while using solvents.
2. Take only small amounts of solvent to the press and use only approved safety cans.
3. Avoid spilling a solvent on the deck; it may flow to where a bystander is smoking and flame up following the trail to the main source.

4. Insure adequate ventilation while using solvents.
5. Do not use solvents directly on your body to remove grease or ink. This may cause a rash.
6. Always place rags and materials used in washing up in a safety approved metal container until they can be dumped.

CLASSIFIED MATERIAL

You should take special precautions in the handling of classified material, since there are many places in a printing press where pieces of torn paper from a sheet jam or even full sheets can hide from the normal quick visual inspection given in clean up operations. For this reason, upon completion of a run of classified material, you should always check base and oil pan area. Look particularly behind motors and belt guards. Inspect every dark corner under the press. Also check the cylinder gaps, around the feedboard area, and the delivery end of the press. You should make sure that no printed sheets are left in the feeder; and last, but not least, you should carefully clean the image off the blanket and impression cylinder, because it is possible to read the image in these areas when the press is left standing. They may also produce a ghost of the old image on the next sheets printed when a new job is put on the press.

Burn bags should be used for waste material at all times when you are running classified jobs. Arrangements should also be made for the disposal of metal plates and the negatives if the job is a one time only run.

FIRE PROTECTION

If a small fire occurs in the print shop, you may be able to extinguish it by taking immediate action with a portable fire extinguisher. However, if the fire is beyond your control, you should spread the alarm and take whatever action is possible until the fire party arrives on the scene. If possible, secure the ventilation system, but don't hand around a smoke-filled compartment until you are overcome. Members of the fire party will be equipped to enter the smoke-filled area and bring the fire under control.

You will find extinguishers distributed at convenient locations in your area. Do not allow the snow formed by the liquid carbon dioxide to contact your skin when you are using the CO_2 applicator; it may produce blisters and cause very painful burns.

Fire prevention emphasizes the importance of good housekeeping and the safe handling of flammable chemicals. The personnel of a lithographic pressroom should also know what fire prevention measures exist. Everyone should be familiar with the following:

1. How to report a fire.
2. What to look for in making a fire prevention inspection of your immediate work area.
3. How to use the fire equipment available.
4. How to ensure that all hands are fire prevention conscious at all times.

Basic Military Requirements, NavPers 10054, discusses various types of fires and fire fighting equipment. You should refer to it for further information on the subject.

SUMMARY

The offset press may be divided into three main parts: the feeder, the printing unit, and the delivery. The inking and dampening systems are a part of the printing unit.

The operation of each of these units is automatic, once the press is set up. The adjustments involved in setting up the press for a new job are known as makeready or press preparation.

At the beginning of the day, the operator oils the press. Then he fills the ink and water fountains and runs the press a few minutes to allow the ink and water to distribute over the rollers.

Next, he clamps the plate on the plate cylinder, adding sheets of paper packing behind it, if necessary, to obtain the proper printing pressure between the plate and the blanket.

The blanket must also be mounted and underpacked, but once this has been done, further changes will be unnecessary unless it becomes damaged or worn. The pressure between the blanket and impression cylinder must be adjusted if the stock to be run is considerably thicker or thinner that that used for the previous job.

Besides adjusting the ink and water for even distribution, the pressman must set the feeder and delivery units for the size of the sheet being run. He must also adjust certain devices on the feed-board which control the sheet as it is carried to the printing unit.

When he starts the press again, he pushes a lever to lower the water rollers to the plate. A moment later, he drops the inking rollers by a similar method. As soon as the plate has inked, he prints a few trial sheets.

He checks these sheets for defects, ink distribution, and the position of the image, and if necessary, stops the press and makes corrections. After corrections have been made, he is ready to start production.

Most presses have two sets of starting and stopping buttons. One controls the press; and the other, the vacuum-pump which supplies the suction and blast for the feeder. These buttons and other control levers are generally located on the near (operator's) side of the press. Larger presses have additional starting and stopping buttons located at the delivery end of the machine.

The press is set in motion when the start button is pushed. But the sheets do not begin feeding through until the operator turns on the vacuum pump and (on some presses) pushes a lever that sets the feeder in motion.

When the feeder is turned on, blowers separate the top sheets in the paper stack (which has been loaded on an automatic elevating feed table). Suction feet then catch the top sheet and move it to the edge of the feedboard, where it is caught by a set of forwarding wheels and forced onto moving conveyor tapes. These tapes carry it to the end of the feedboard. There it is squared for register by the side and front guides.

Just before the sheet reaches the front guides the impression goes on automatically or the operator pushes a lever that throws on the impression so that the image will print.

The front guides then life (or recede) to release the sheet, and a set of grippers (contained in a recess in the impression cylinder) close on the edge of it and draw it through the printing unit.

As the cylinders revolve, the plate is carried first under the water rollers; then under the inking rollers; and finally, against the blanket. The blanket receives the inked image and transfers it to the paper which is forced against it by the impression cylinder.

As the sheet emerges from the printing unit, the cylinder grippers release it to a set of traveling delivery grippers. These grippers carry the sheet to the end of the press and deposit it on a delivery platform. Automatic joggers keep the stack of printed sheets even, and an automatic lowering device lowers the platform as the sheets are delivered.

At the end of the run, the pressman removes the plate and prepares it for storage. He then washes the blanket and sets up the press for the next job to be run. At the end of the day, he removes the ink from the fountain and washes and cleans the press thoroughly.

Operating parts and adjustments vary from press to press, but if a pressman understands the basic operating principles, he can switch from one model to another with a minimum of instruction.

PRESS DIFFICULTIES

Difficulty	Cause	Remedy
1. Plate does not take ink.	a. Form rollers do not contact plate.	Check setting of form rollers by dropping inked rollers against a dry plate. Inked lines left on plate should be 1/8 to 3/16 inch wide and uniform from end to end. Adjust form rollers if necessary.
	b. Plate entirely blind	Image does not accept ink, due to defect in plate. Dry plate and reduce water supply. If this does not help, replace plate.
2. Plate not inked uniformly.	a. Ink fountain incorrectly adjusted.	Adjust thumbscrews on fountain as necessary.
	b. Rollers improperly set.	See item 1a.
	c. Rollers glazed	Usually due to ink and drier remaining in pores of rollers. Shut down press; remove rollers and wash thoroughly with roller wash. Remove glaze with fine pumice powder and roller wash. If extensive, have roller reground.
	d. Metal rollers stripping. (Rollers fail to take ink.)	If due to glazed rollers, correct as in item 2c. If not, wash metal rollers with 2 percent nitric, acetic, or hydrochloric acid solution on rag, assisting with pumice powder. Wipe with roller wash and with water after applying acid.
	e. Dampeners improperly set.	Check setting of form roller by dropping it against a dry plate. Examine wet line on plate. It should be 1/8 to 3/16 inch wide and even from end to end. If it is not, adjust dampener form roller as necessary.
3. Plate does not print or prints unevenly on blanket.	a. Insufficient pressure, or cylinders not parallel.	Check setting between cylinders. Adjust as necessary.

57.557.1

PRESS DIFFICULTIES–Continued

Difficulty	Cause	Remedy
3. Plate does not print or prints unevenly on blanket–Con.	b. Low areas	May be due to worn blanket or injury or warping of cylinder. Underpack low areas of blanket with pieces of tissue paper torn to conform to shape of low areas. Secure with rubber cement.
	c. Dents in blanket	If not severe, dents usually disappear if left alone. Swell blanket in low area by holding rag dampened with blanket wash over it for 2 or 3 minutes. If dents are deep, shift plate or reverse blanket so dent does not show in printing.
	d. Water and ink distribution unbalanced.	Check and correct distribution as necessary.
	e. Blanket glazed	Wash thoroughly with water and gasoline to remove deposits of gum and ink. If still glazed, remove from press and scrub well with roller wash and pumice powder.
	f. Defective plate	Inspect plate in doubtful areas with magnifying glass to see if plate is at fault. If image appears to be glazed over, go over glazed areas with etch; then rub up image. If this does not work, replace plate.
	g.. Gum streaks	Gum may not be applied evenly or gum may be soured. Results in image areas being desensitized to grease. Wash out with plate wash. Rub up wet with alternate strokes of a wet sponge and rag dabbed in press ink.
4. Image does not print on paper.	a. Paper does not feed properly.	Check feeder setup.
	b. Improper contact between impression and blanket cylinder.	Adjust pressure between blanket and impression cylinder.
5. Impression not uniform.	a. Impression poor on plate or blanket.	See corrections for plate or blanket, items, 1, 2, and 3.

57.557.2

PRESS DIFFICULTIES—Continued

Difficulty	Cause	Remedy
5. Impression not uniform—Con.	b. Impression cylinder out of parallel with blanket.	Adjust as necessary.
6. Ink impression too heavy.	a. Too much ink	Reduce number of notches of ink feed or turn fountain adjusting screws back uniformly.
	b. Ink too soft.	Stiffen ink with small quantity of No. 8 varnish (body gum). See chapter 18 for discussion of inks.
	c. Insufficient water	Usually associated with local catch up of ink. Increase water to minimum required to print properly.
	d. Image slurred or streaked.	May be due to end play in form rollers. Check and reduce play as necessary. May also be due to glazed form rollers slipping. Remove glaze.
	e. Double image	Due to loose blanket. Tighten as necessary.
7. Impression gray.	a. Too much water	Reduce water to minimum required for printing without ink catching up.
	b. Insufficient ink	Increase ink supply at fountain.
	c. Poor plate	See items 3f and 3g.
	d. Blanket glazed	See item 3e.
	e. Insufficient printing pressure.	See item 4b.
	f. Emulsified ink	Ink has absorbed excessive water. Replace ink.
8. Plate scums, tints, or fills in.	a. Defective plate	Attempt to clean plate with strong plate etch or concentrated fountain solution. If this does not remove scum, replace plate. To remove local tint, use snakeslip followed with plate etch and then wash with water.
	b. Insufficient water	Increase water feed.

57.557.3

PRESS DIFFICULTIES—Continued

Difficulty	Cause	Remedy
8. Plate scums, tints, or fills in—Con.	c. Insufficient acid in water.	Replace fountain solution with properly mixed solution if necessary.
	d. Poor ink	Replace ink.
	e. Dirty dampeners	Wash dampeners with water and ink solvent or change covers.
	f. Coated paper	Paper not intended for offset printing may contain chemicals that cause plate to scum. If such stock is used, frequent washups and more acid in fountain may be necessary.
	g. Oxidized plate.	May be due to faulty platemaking or graining operation or to plate drying on press. Application of strong etch may help; otherwise discard plate.
	h. Scumming or catch up on sides.	May be caused by dampener covers drawn too tightly over ends of rollers. Correct cause.
	i. Old work shows through as ghost image.	Due to defective plate or blanket. For defective plate, see item 8a. If due to defective blanket, replace with new blanket and hang old one up to dry. On Multilith, ghost images (about 1/2 inch below main image) may be due to too much tension on dampener form roller or insufficient water. Correct cause.
	j. Local catch up of ink on plate.	May be due to unevenness in molleton covers on dampeners or dampeners not contacting plate uniformly. Adjust form roller to contact plate uniformly. Change cover if necessary.
9. Image disintegrates (walks away).	a. Fountain solution incorrect.	Prepare new solution following directions on bottle or add more water.

57.557.4

PRESS DIFFICULTIES—Continued

Difficulty	Cause	Remedy
9. Image disintegrates (walks away)—Con.	b. Incorrect pressure between blanket and impression cylinder or segment.	Too much pressure will cause wear on plate. Adjust as necessary.
	c. Defective plate	Try procedure in item 3f, or replace plate.
10. Paper difficulties.	a. Paper plucks in printing.	Ink may be too stiff for a coated or soft stock. Reduce with No. 00 varnish.
	b. Does not feed properly.	Jog paper to separate sheets and get air between them before loading press. Adjust feeder to lift paper properly. Check suction and blast. If necessary clean valves and suction and blast lines. Adjust front and side guides, feed rollers, caliper, and other controls if necessary.
	c. Paper does not lie flat.	Due to variation in absorbed moisture in paper. Condition paper by hanging or separating stock into small piles. Run stock through the press against a blank plate (with dampeners but not ink rollers on) to equalize moisture content.
	d. Double sheeting.	Check suction and blast; lower height of stack. Adjust separator finger and caliper if necessary.
	e. Suckers fail to pick up sheet.	Increase suction and blast. Raise stack; remove separator finger if necessary.
	f. Stock damages blanket.	Generally due to heavy stock. Addust pressure between blanket and impression cylinder or segment. Use old blanket when running heavy stocks.
11. Misregister.	a. Parallel displacement of image.	Adjust press to register by shifting side guides or rotating undercut section of plate cylinder as required. On Multilith, check cam band adjustment.

57.557.5

PRESS DIFFICULTIES—Continued

Difficulty	Cause	Remedy
11. Misregister—Con.	b. Image twisted on plate.	Shift plate on cylinder.
	c. In color work, image for second color does not register with image for first color.	May be due to change in moisture of stock. Try conditioning stock as in item 10c. May also be due to incorrect camera setting or change in size of film negative. If error is large have plate remade.
	d. Varying misregister.	Usually occurs in feeding. Reduce bounce of paper by aligning pile to minimum contact required by side guide. Set brush or skid (rider) rollers just off tail edge of sheet when it is against the front guides to prevent sheet from bouncing when it hits the guides. Use additional sheet controls to drag on sheet or reduce speed of press.
12. Ink offsets from one sheet onto the back of another.	a. Excessive ink	Reduce ink supply at fountain.
	b. Ink does not dry. Due to insufficient drier; excessive vehicle; excessive humidity or emulsification of ink.	Add drier to ink as necessary. If ink is emulsified, replace. Reduce press speed.
	c. Coated stock	Coated or hard finished stock requires more drier in ink. Decrease press speed.
	d. Static electricity	Static is encountered whenever the relative humidity of the pressroom falls below 35 percent. When present, sheets cling together or to the press, interfering with normal feeding and printing. To eliminate, increase humidity of pressroom. Static difficulties can be reduced by grounding press and by stretching tinsel across press at several places along paper delivery path to absorb static charge in paper.

57.557.6

PRESS DIFFICULTIES—Continued

Difficulty	Cause	Remedy
12. Ink offsets from one sheet onto the back of another—Con.	e. Sheets piled too high in paper receiver.	Weight of stack forces sheets together and causes offset. Empty receiver after each 500 sheets or oftener if necessary. Do not stack wet sheets in tall piles.

57.557.7

CHAPTER 12

THE MULTILITH 1250

THE NAVY'S SMALL OFFSET PRESSES

Smaller offset presses are often referred to as duplicators. These presses operate on the same principle as large presses, but they are generally easier to operate and require less floor space. Of the various types of duplicators, the Multilith 1250, manufactured by AM Corporation, is the model found most often in Navy print shops afloat and ashore.

MULTILITH 1250

There are several models of the basic Multilith 1250 offset press. Shown in figure 12-1 is the standard model of the press. The same basic press is shown in figure 12-2 with a receding stacker delivery unit. In addition to the difference of the two presses shown, you may find slight changes in different presses, depending on when they were manufactured. For instance, the single lever control is a relatively new feature that was introduced in 1965. There are many presses still in use without this feature.

Press Specifications

The standard 1250 press prints sheets as large as 11" X 14" and as small as 3" X 5". Its' maximum image area is 9 1/2" X 13" with a minimum sheet lead edge gripper margin of 5/16". There is another model of the basic press, designated a 1250W, which is equipped with 16 1/2" cylinders which increases the maximum image size to 1/2" X 16 1/2" with a maximum sheet size of 11" X 17".

Unless specifically noted, all references in this chapter pertain to the basic 1250 model press. It should be noted however that with the exception of certain adjustments to the plate and blanket cylinders, the majority of the operator's controls and press adjustments are the same for either the 1250 or 1250W.

The press speed, usually designated as "impressions per hour" or IPH, is 4,500 to 9,000. When the sheet being printed is over 14" long, it is recommended that the press by run at a maximum of 6000 IPH. Stock weights from 13 lb. bond to 3-ply card stock can be run through the press. The capacity of the feeder unit is 5000 sheets of 20 lb bond paper.

Operator's Controls

The operator's controls and press components are shown in figure 12-3. The sheets are fed through the press when the machine switch and vacuum feed switch are flipped up and the blower and vacuum controls are adjusted so that the sheets are fed evenly and consistently into the press.

A lever called the single lever control operates the printing unit. There are four lever positions: Off; Moist; Ink; and Print. (See figure 12-4.)

The sheet counter registers up to 99,999 and can be manually reset by the knurled wheel. The counter only registers the sheets that pass through the printing unit; it does not count cylinder revolutions.

The speed control knob is located at the delivery end of the press. The speed control should be adjusted only when the press is operating.

DAMPENING (REPELEX) SYSTEM

Figgure 12-5 shows a diagram of the printing unit of this press, and figure 12-6 shows a close-up of the dampening unit. The dampening is identified by the manufacturer as the Repelex

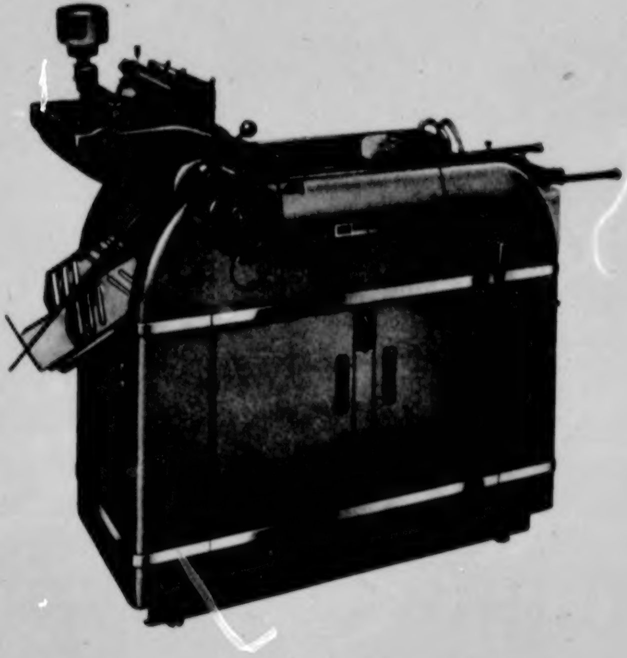


Figure 12-1.—Multilith model 1250 offset press.

57.741(57C)AX

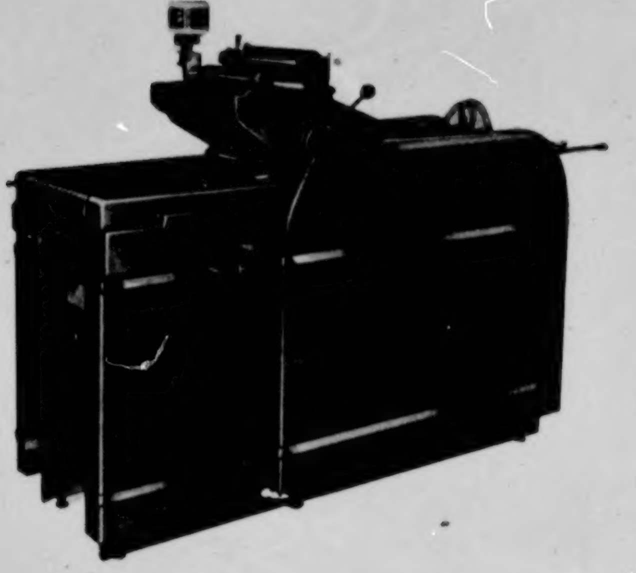
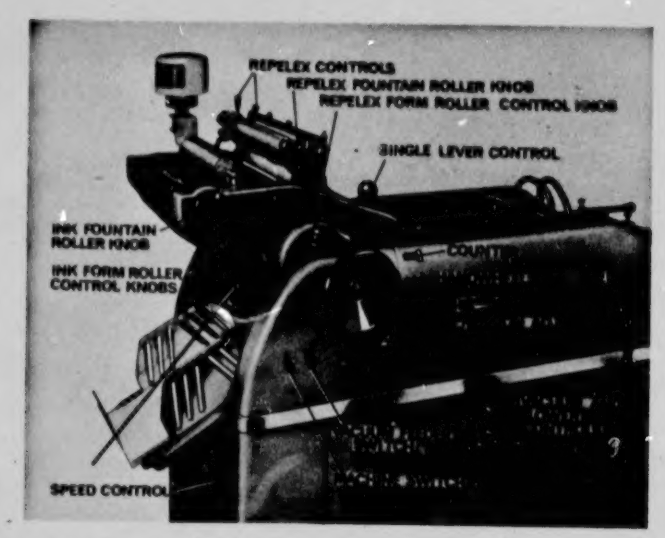


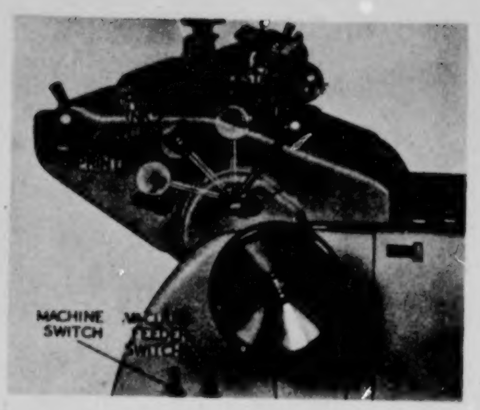
Figure 12-2.—Multilith 1250 press equipped with a chain delivery unit.

57.742X


REPELEX CONTROLS
REPELEX FOUNTAIN ROLLER KNOB
REPELEX FORM ROLLER CONTROL KNOB
SINGLE LEVER CONTROL
INK FOUNTAIN ROLLER KNOB
INK FORM ROLLER CONTROL KNOBS
COUNTER
SPEED CONTROL

57.741(57C)BX

Figure 12-3.—Operator's controls.


MACHINE SWITCH

57.743X

A. Lock nut

Figure 12-4.—Positions of the single control lever.

unit, which is the trade name of the fountain solution sold by AM Corporation.

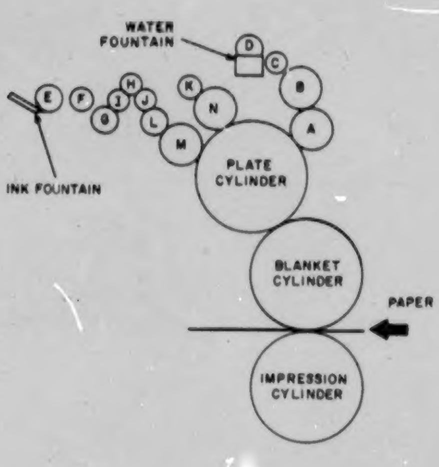
The dampening (repelex) system consists of four rollers, a water fountain, and a large plastic bottle which acts as a reservoir for the fountain solution. The fountain solution is prepared according to the instructions for its use and poured in the bottle which is then placed in the fountain in an inverted position. (See fig. 12-7.) As the fountain solution is expended, a valve within the bottle releases solution from the bottle to replenish the supply and keep the fountain solution at a constant level in the fountain.

The dampening rollers shown in figure 12-5 include a molleton-covered form roller (A), a metal oscillating rider roller (B), a molleton-covered ductor roller (C), and a knurled fountain roller.

When the press is in operation, the knurled fountain roller revolves in the fountain pan, picking up a thin film of water, which it yields to the molleton-covered ductor roller. The ductor roller swings back and forth, alternately touching the fountain roller and the rider roller.

The rider roller receives the solution from the ductor and distributes it to the form roller. The form roller, of course, contacts the plate, keeping it moist.

The form roller control knob (A) shown in figure 12-6 is provided for raising or lowering the form roller. To drop the roller, you simply



A. DAMPENING FORM ROLLER
B. OSCILLATING RIDER ROLLER
C. DUCTOR ROLLER
D. DAMPENING FOUNTAIN ROLLER
E. INK FOUNTAIN ROLLER
F. DUCTOR ROLLER
G. LOWER FIXED DISTRIBUTOR ROLLER
H. UPPER DISTRIBUTOR ROLLER
I,J,K. IDLER DISTRIBUTOR ROLLERS
L. LOWER OSCILLATING ROLLER
M. LOWER INK FORM ROLLER
N. UPPER INK FORM ROLLER

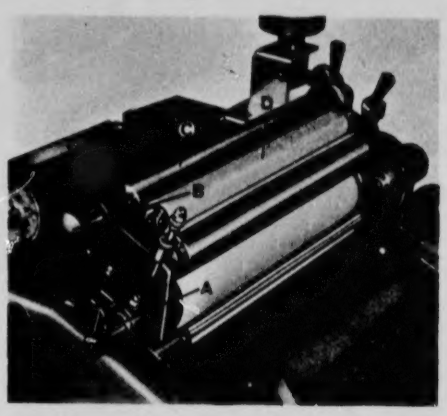
57.245

Figure 12-5.—Diagram of the printing unit of the 1250 press.

turn the knob ¼ turn counterclockwise (pointing toward the delivery end of the press), to the "on" position. The contact action of the form roller to the plate cylinder is now controlled by the single lever control (figure 12-4). To raise the roller, move knob (A) back to its vertical position "off".

The water supply is regulated by a ratchet which controls the number of revolutions per minute of the fountain roller. To increase the supply, you must push the feed control lever (A), shown in figure 12-7, toward the delivery end of the press. Pushing the lever in the opposite direction decreases the supply, and if the lever is pushed all the way down (toward the feeder end of the press) the water is shut off completely.

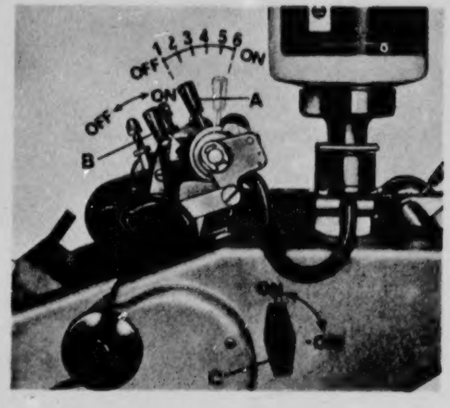
You can also cut off the water supply by moving the contact lever (B), figure 12-7, toward the feeder end of the press. This breaks the contact between the ductor and the fountain roller.



57.246(57C)X

A. Form roller control knob
B. Fountain roller knob.
C. Fountain roller (metal)
D. Ductor roller

Figure 12-6.—Dampening (Repelex) unit.



57.744X

A. Feed control lever
B. Contact lever
C. Ink form rollers might latch

Figure 12-7.—Dampening controls.

The rollers dry out if the press is shut down for any length of time. Therefore, at the beginning of the day or after a long shutdown period, most operators distribute water over the rollers with a sponge, repeating the process 4 or 5 times until the rollers are damp enough to begin operations. During a run, you can quickly and evenly increase the water supply to the rollers by rapidly making one or two clockwise turns of the fountain roller knob (B), figure 12-6, at the time the ductor roller contacts the fountain roller.

INKING SYSTEM

As you can see in figure 12-5, the inking system on this press consists of an ink fountain and 10 rollers. In addition to the fountain roller (E) and the ductor roller (F), there are 2 form rollers (M and N), 2 distributor rollers (G and H), 3 idler distributor rollers (I, J, and K), and 1 fixed oscillating roller (L). (A large-diameter auxiliary oscillator roller may be substituted for the upper distributor roller (H). This larger roller acts as a reservoir to supply an increased volume of ink to the form rollers.)

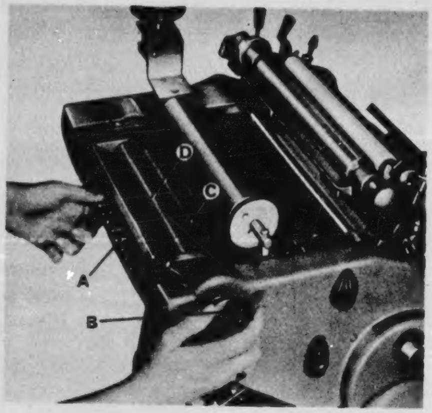
As you have seen in chapter 11, the ink fountain consists of a steel blade attached to a metal roller in such a way as to form a reservoir or trough for the ink. The fountain roller is covered with a thin film of ink as it revolves in the fountain. It gives up a part of this ink each time the ductor roller touches it. The ductor roller, in turn, transfers the ink to the lower distributor roller. See figure 12-5 for the path of the ink to the form rollers and to the image on the plate.

The form rollers are dropped into position by turning the ink form roller control knobs (see figure 12-3) to the left. The rollers actually do not contact the plate until the single control lever shown in fig. 12-4 is placed in the "Ink" position.

On the far side of the press is a night latch or disengaging lever (C) shown in figure 12-7. You should turn this lever to its vertical position to release the tension on the ink form rollers when you shut the press down at night or for an extended period of time. Before you prepare the inking system for operation, you should place the lever in the horizontal or "on" position.

To put ink in the fountain, you turn the press handwheel (figure 12-3) until the ductor roller is out of contact with the fountain roller. Then add ink to the fountain with an ink gun. During operation of the press, you may add ink as needed to assure a steady flow of ink to the fountain roller.

The ink fountain is provided with a row of adjusting screws (A), figure 12-8, which are used to adjust the flow of ink to the fountain roller. When setting the screws at the beginning of the run, you should start in the center and work toward the ends of the fountain. Ensure that the ductor roller is not contacting the fountain roller and adjust each screw until you have an even film of ink on the entire roller, as you turn the ink fountain roller counterclockwise with the fountain roller knob (B), figure 12-8. Turning the screws in reduces the ink flow and turning them out increases the flow of ink. After you have adjusted the flow of ink to the fountain roller, turn the press handwheel until the ductor roller (C) contacts the ink fountain roller (D) as shown in figure 12-8. Turn the fountain roller knob a few turns and check the film of ink on the ductor roller for smoothness



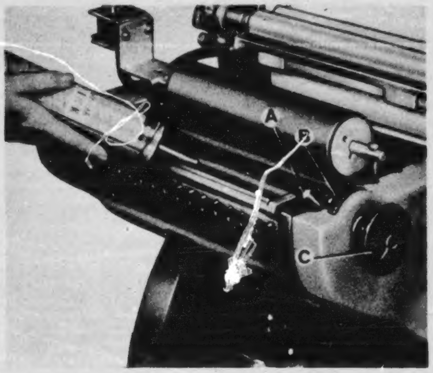
57.745X

A. Ink fountain keys
B. Ink fountain roller knob
C. Ink ductor roller
D. Ink fountain roller

Figure 12-8.—Adjusting ink fountain keys.

and evenness. Further adjustment of the adjusting screws may be necessary to obtain a smooth, even film of ink.

The amount of ink flowing from the fountain roller to the inking rollers may be regulated by the ink control lever (A) figure 12-9 over a range of 16 positions on the scale (B). Placing the lever on zero on the scale shuts off the ink supply. Moving the lever up on the scale gradually increases the flow of ink. For the average running position, you should place the lever between #4 and #8. When you are preparing the press for operation or if you require an extra amount of ink during a run, you turn the fountain roller knob (C) a few extra turns by hand as the ductor roller contacts the fountain roller.



57.247(57C)X

A. Ink control lever
B. Scale
C. Ink fountain roller knob

Figure 12-9.—Ink fountain.

BLANKET CYLINDER

The blanket is provided with loops which may be attached to hooks on each end of the blanket cylinder as shown in figures 12-10 and 12-11. To attach the blanket to the cylinder, rotate the handwheel to turn the press by hand until the hooks in the lead clamp (B), figure 12-10, are accessible. Attach the loops in one end of the blanket to the hooks of the lead clamp. Hold the trailing end of the blanket taut and turn the handwheel until the hooks in the trailing clamp (A), figure 12-11, become accessible. After both ends of the blanket have been attached, stretch the blanket taut by tightening the clamp screws (B) and securing them with locknuts (C), as shown in figure 12-11. Run 30 to 40 impressions and then check the clamp screws and retighten them if necessary.

It is not necessary to underpack the blanket with paper unless it is damaged or worn. You can often bring up low areas on damaged blankets by spotting or underpacking them with pieces of paper.

Most operators keep least two blankets on hand, rotating them periodically so that each can have a resting period. This lengthens the life of the blanket. When a blanket is not in use, a coating of dust bloom) may form on its surface, so always clean blankets thoroughly with blanket wash and lightly dust the rubber surface with Multilith "Blanket dust" before stowing the blanket or putting it on the press.

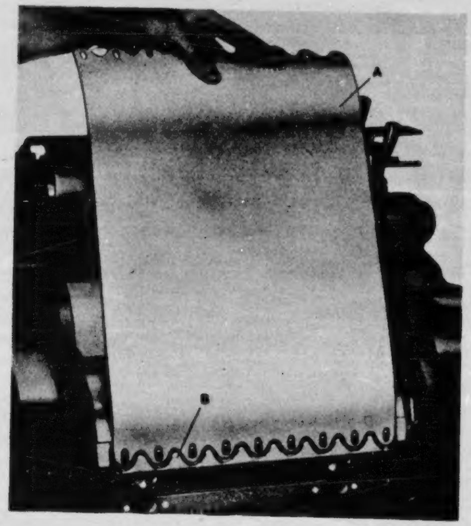
MOUNTING THE PLATE

The Multilith 1250 uses all types of plates including those made from metal, paper, or plastic. The most common style of plate used on the press is the punched type. The holes in each end of the plate simply fasten over the hooks on the plate cylinder. (See fig. 12-12.) Spring tension on the tail clamp normally holds the paper masters taut, although it is best to tighten the metal plate around the cylinder with the thumbscrew that is located on the tail clamp.

Some models of the press are equipped with a plate cylinder clamp that accepts straightedge plates as well as the looped or punched type. To insert a straightedge plate, you must depress the clamp with your left hand as you insert the plate into the clamp with the right hand.

Straightening the Plate on the Cylinder

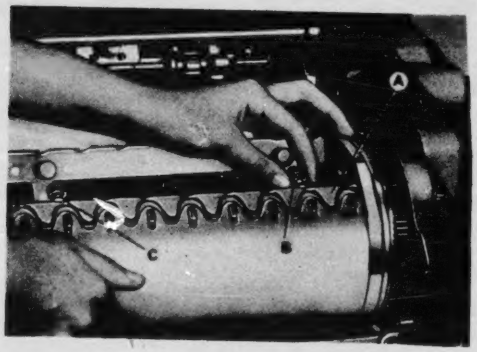
If the image is not straight on the plate, it will be necessary for you to shift the plate on the



57.248.1(57C)X

A. Blanket
B. Lead clamp with blanket hooks

Figure 12-10.—Installing a blanket.



57.248.2(57C)X

A. Tail blanket cylinder clamp
B. Clamp screw
C. Lock nut.

Figure 12-11.—Clamping the blanket to the blanket cylinder.

cylinder so that the image will be square with the paper. You can twist the plate on the cylinder with the notched adjusting screws (A) and (D) shown in figure 12-13. Loosen thumbscrews (B) and (F) and then turn notched adjusting screw (A) in one direction and screw (D) in the opposite direction until the image is square with the sheet.

Raising or Lowering the Image

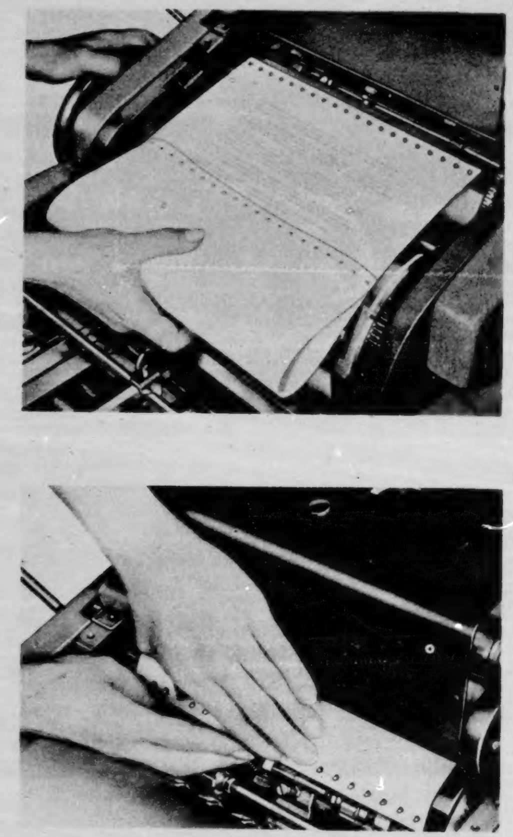
You can raise or lower the image on the sheet by rotating the undercut section of the plate cylinder. To move the undercut section, you must turn the press until a hexagon-shaped bolt at the far end (near the lead edge) of the plate cylinder is aligned with the vertical positioning control knob (B), until the socket on the end of the knob slips over the bolt on the cylinder. (See fig. 12-14.) Loosen the bolt by turning the knob counterclockwise. Then hold the knob firmly while you turn the press by hand in a clockwise direction to raise the image or in a counterclockwise direction to lower it.

As you can see in figure 12-14, a scale is provided along the cylinder gear and a line is scribed in the undercut section of the cylinder to enable you to tell how far you move the undercut section. When you have moved it the proper distance, retighten the hexagon bolt and disengage the vertical positioning control knob (B). Then wash the blanket and pull another impression. Check the new position to see if further adjustments are necessary.

AUTOMATIC FEEDER

The feeder consists of an elevating feed table, a feedboard, front and side guides, a pile-height bar, sucker feet, blast pipes, and various paper controls. The function of each of these parts was described in chapter 11.

When you are ready to set the feeder, measure off on a piece of stock to be run the amount of margin to be allowed on the left side of the sheet. Indicate this measurement by making a small pencil mark aligned with the left edge of the image on the plate.

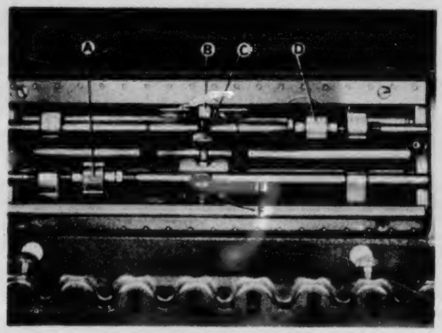


57.250(57C)X

Figure 12-12.—Attaching plate or master to plate cylinder.

Next, measure the distance from the left edge of the plate to the left edge of the sheet. This distance will determine the setting of the left guide (H), shown in figure 12-15. For example, if the distance from the edge of the plate to the edge of the sheet is 1 1/2 inches, you should set your left side guide 1 1/2 inches from the left end of the locating scale (E) shown in the illustration.

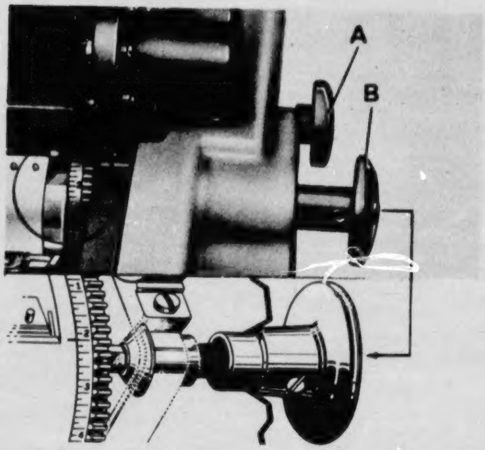
Turn the press until the left side guide is at the end of its inward thrust. Then loosen lock screw and move the side guide to the proper position, along the locating scale. Tighten the lock screw to hold the side guide in this position. You can make minute adjustments



57.252(57C)X

A. Lateral adjustment screw
B. Lock nut
C. Plate tension adjusting screw (lead edge)
D. Lateral adjustment screw
E. Plate tension adjusting screw (tail edge)
F. Lock nut

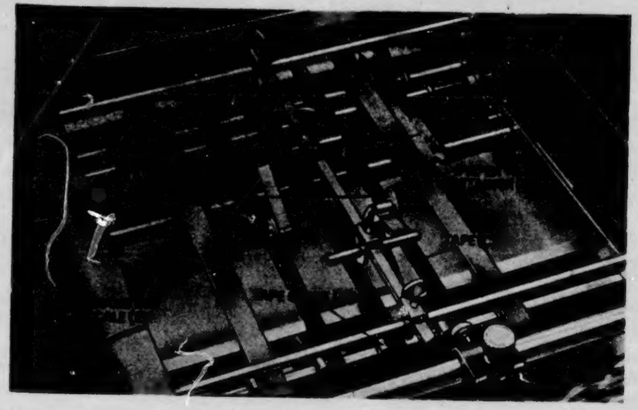
Figure 12-13.—Plate cylinder adjustment controls.



57.253(57C)X

A. Night latch
B. Vertical positioning knob

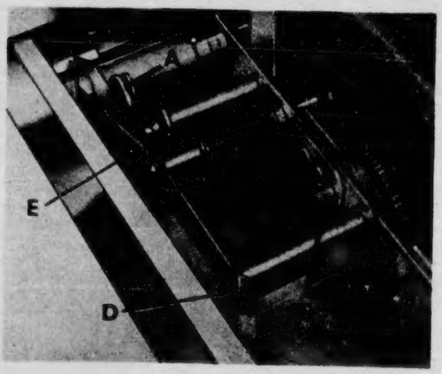
Figure 12-14.—Plate cylinder vertical positioning control knob.



57.254(57C)X

Figure 12-15.–Feedboard.

later, if necessary, with the micrometer disk (C), shown in fig. 12-16. Raise the lock pin (B) to release the disk and turn the disk clockwise to allow more margin on the left side of the sheet or counterclockwise to allow less.



57.746X

A. Squeeze clamp
B. Lock pin
C. Micrometer disk
D. Guide
E. Register spring

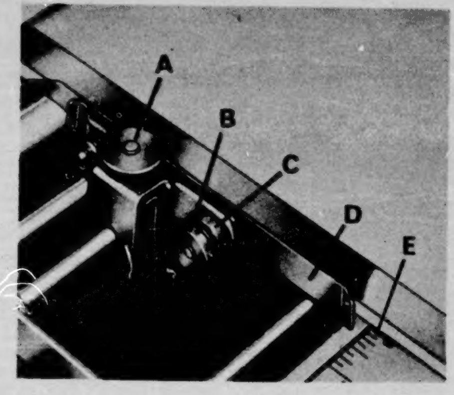
Figure 12-16.–Right side guide.

Once the left side guide is set, place a sheet of the stock to be run on the feedboard, squeeze clamp (A), and move the stationary guide (D) inward until the register spring (E) is compressed approcimately 1/16″ against the sheet. The register spring keeps the sheet in light contact with the jogger guide.

If the paper tends to feed crooked as it enters the printing unit, you should check to see if the left side guide is parallel with the edge of the sheet. Place a sheet of stock against the front and side guides. If the left edge of the sheet is not parallel with the side guide when the sheet is resting squarely against the front guides, adjust the guide by loosening lock nut (B) and turning the adjusting screw (C), shown in figure 12-17, until the guide is parallel with the sheet. Then tighten lock nut (B).

Loading the Feeder

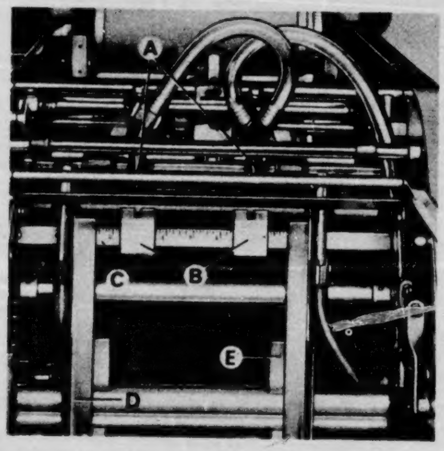
Once the side guides are set, you are ready to load the paper onto the feed table. The feed table is lowered by pushing the release lever to the right and turning the handle counterclockwise. The feed table release lever and handle are located to the rear of the press on the operator's side. Next, position the piling bars (D) and (E), shown in figure 12-18, by releasing them with the lever located at the end of the press. Set the left piling bar to the position along the scale (C) that corresponds to the position of



57.747X

A. Lock screw
B. Lock screw
C. Adjusting screw
D. Guide
E. Scale

Figure 12-17.—Close-up of left side guide.



57.748X

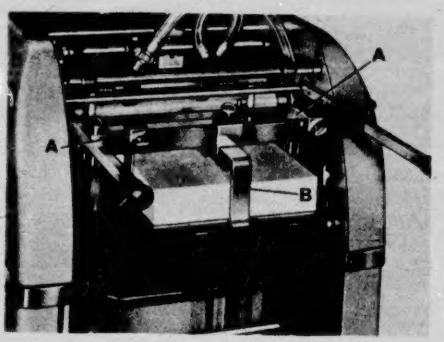
A. Suction feet
B. Sheet separators
C. Scale
D. Left piling bar
E. Right piling bar

Figure 12-18.—Feeder unit.

the left side guide along the scale on the feedboard. Then set the right pile guide to the width of the stock.

Before loading the paper into the press, you should fan or jog it to introduce a blanket of air between the sheets. Then load it onto the table, as shown in figure 12-19. When the stock is loaded, turn the crank clockwise to raise the table until the top of the paper stack is approximately 1/4 of an inch below the separator fingers (D), shown in figure 12-20.

Next, move the back stop (B) and the stack guides (A) into position, as shown in fig. 12-19. The guides (A) should clear the sides of the stock, and the stop (B) should press lightly against the back edge of the stack. You can reverse the position of stop (B) when you are feeding short stock so that it will give better sheet control.



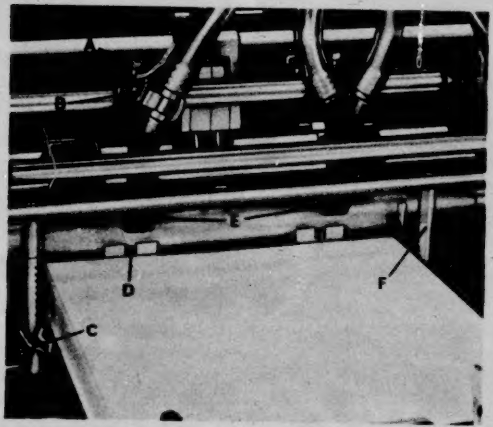
57.256(57C)X

A. Stack guides
B. Back guide

Figure 12-19.—The paper is loaded on the feed table and the right and left stack guides and back guide are adjusted to the edges of the paper.

Adjusting Suction and Blast

The press is set in motion with the machine switch shown in figure 12-3 is thrown, but the sheets do not begin feeding through until the operator turns on the vacuum pump switch.



57.257(57C)X

A. Lock nut
B. Suction foot shut-off button
C. Blower tube
D. Sheet separator
E. Suction feet
F. Blower tube

Figure 12-20.—Close-up of the feed table.

When the vacuum pump is turned on, two blowers at the front of the paper stack provide a blanket of air that floats the top sheet in the pile. Two sucker feet then dip down to pick up the top sheet and move it to the edge of the feedboard where it is caught by two pullout rollers. These rollers force the sheet onto the conveyor tapes which carry it down the feedboard to the printing unit.

The blower tubes are shown in fig. 12-20. These tubes are attached to the piling bars by means of a metal clip or bracket (C). The tubes should be kept in the front position of the bracket for normal weights of paper stock as shown in the illustration. When you are running lightweight stock through the press, the blower tubes should be moved to the back position.

When necessary, the blower tubes can be raised or lowered by loosening the screw that holds the tube to the piling bar. Each blower should be set with the top hole just slightly above the top of the paper stock. The amount of blast directed to the stack is controlled by the blower control knob, shown in fig. 12-3.

Check the sheets at the start of the run to see if they are feeding properly, and then adjust the blast, if necessary, while the press is in operation. Turning knob clockwise decreases the blast and vice versa.

The sucker feet (E), shown in figure 12-20, should be spaced evenly along the front edge of the stock. You can loosen the setscrews (A) and move them sidewise as necessary.

You can adjust the suction with knob shown in figure 12-3, at the start of the run if the suckers fail to pick up the sheets or if they pick up two sheets at a time. In general, you should use less vacuum for thin stocks and more when you are running heavy stocks. You can push a button (B), shown in fig. 12-20, to close off the suction on the left sucker foot entirely when you are running small sized stock and only one sucker foot is necessary.

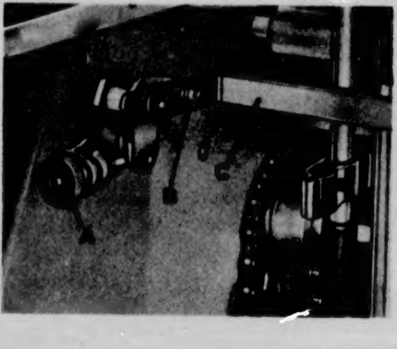
Separator Fingers

Two small metal fingers, called separator fingers, ride the edge of the stock just enough to prevent the suckers from picking up two sheets at a time. The tip of the finger (D), shown in figure 12-20, ordinarily overlaps the stock by about 3/16 inch. However, you may set it for maximum extension when you are running thin stock or remove it entirely when you are running cardboard. You should position the separator fingers under the two sucker feet. Loosen the thumbscrew at the bottom of the separator finger brackets when it is necessary to reposition the fingers.

Pile Height Control

When the press is in operation, you can change the height of the stack by turning the knob (A), shown in figure 12-21, in the direction marked "raise" or "lower."

Although it will seldom be necessary, you can change the speed of elevation of the feed table, by loosening the screw (B) and moving the height control bar (C) toward or away from the sucker feet. (Note: There are two screws holding the bar; one on each side.) Moving the bar toward the sucker feet causes the stack to rise slower and vice versa. For the average run of



57.255(57C)X

A. Control knob
B. Lock screw
C. Pile height bar

Figure 12-21.—Pile height mechanism.

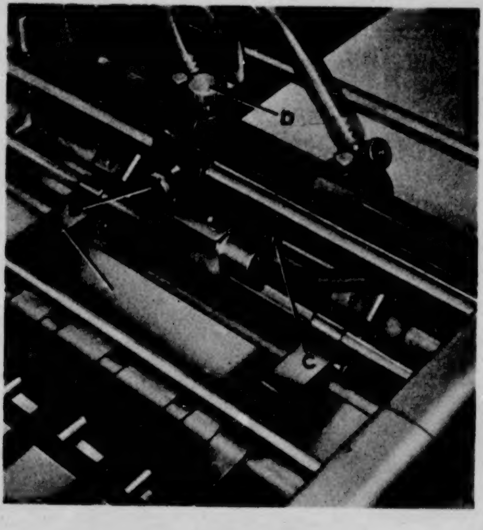
work, most operators leave this bar set about 1 1/2 inches from the sucker feet when the suckers are all the way down.

Adjusting the Caliper

You have just seen that separator fingers are provided to prevent more than one sheet at a time from being fed into the press. However, the suckers may still pick up two sheets occasionally if the paper sticks together or if the suction or blast is incorrectly adjusted. For this reason, the Multilith is equipped with a device known as the multiple sheet detector or caliper which automatically deflects or throws out the sheets if two or more are fed through. These deflected sheets fall into a metal tray (A) located just below the conveyor belts. (See fig. 12-22.)

When setting the caliper, lower the feed table so that no stock will feed through; then turn on the press and the vacuum. Next, fold a piece of paper so that you have a double thickness at one end and a single thickness at the other. Work this paper back and forth under the detector roller (C) and adjust the knurled screw (D) until the single thickness slides under the roller freely, while the folded end (double thickness) of the paper trips the deflector mechanism.

You can move the caliper sidewise by loosening the lockscrew (B) and sliding the unit along the rod to which it is attached. It is generally centered between the sucker feet, but you should not set it so close to them that it will interfere with their operation.



57.258(57C)X

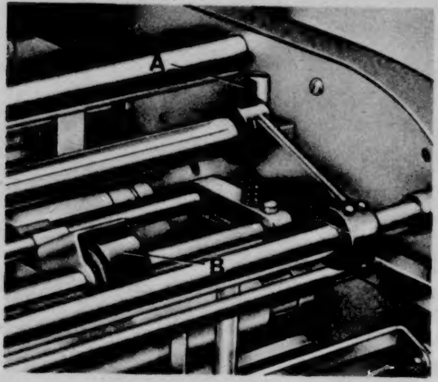
A. Deflector
B. Lock screw
C. Detector roller
D. Adjusting screw

Figure 12-22.—Double sheet detector (caliper).

Pullout Rollers

The upper pullout rollers (B), shown in figure 12-23, pull the sheet off the stack as it is lifted by the sucker feet and force it over a lower roller and onto the moving conveyor tapes which carry it down the feedboard. The two upper pullout rollers are adjustable sidewise to accommodate different widths of stock. You should set one on each side of the suckers, approximately halfway between the suckers and the piling bars.

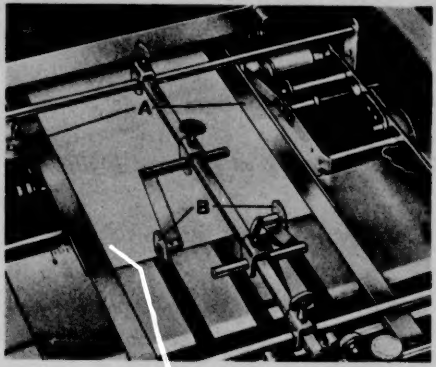
The tension on these rollers is controlled by an adjusting screw at each end of the roller shaft. If there is more pressure on one side than on the other, the sheets will feed crooked, and you must reset the rollers with the adjusting screws (A), shown in figure 12-23. Turn the



A. Adjusting screw
B. Forwarding roller

57.259(57C)X

Figure 12-23.–Close-up of the forwarding roller and adjusting screw.



A. Paper retainers
B. Skid rollers

57.749X

Figure 12-24.–The paper retainers and skid rollers help control the sheet just before it enters the printing unit.

adjusting screw (on the side affected) in a clockwise direction to reduce the tension and vice versa. Tightening the rollers increases the speed of the paper, of course.

Sheet Controls

The five conveyor tapes which carry the paper down the feedboard are also adjustable sidewise to accommodate different widths of stock. To move the tapes, you must push the guides under the feedboard. Always set the outer tapes near the right and left side guides and space the other tapes evenly between them.

Two metal strips, known as paper retainers, are used for controlling the paper as it is carried down the feedboard. These paper retainers (A), shown in figure 12-24, should be positioned over the two outside conveyor tapes.

In addition to the paper retainers, most presses are equipped with the two removable skid rollers (B), shown in figure 12-24. These rollers provide greater sheet control when short, heavy stock is being run. Most pressmen position the skid rollers so that they are just off the tail end of the paper when the sheet is resting against the front guides. This prevents the sheet from bouncing away as it strikes the front guides and makes for better registration.

Front Guides

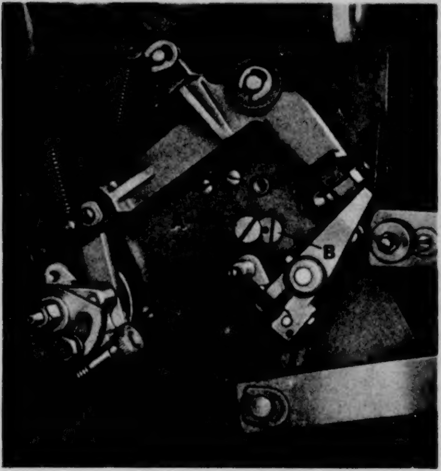
As the paper reaches the end of the conveyor tapes, it is stopped momentarily by a set of pins (front guides). The left side guide then pushes the sheet sidewise so that it is properly positioned (registered) to enter the printing unit.

A moment later, the front guides recede (drop down) to clear the front edge of the paper, and a metal feed roller lowers against the sheet to forward it into the gripper fingers on the impression cylinder.

The front guides and feed rollers seldom need adjusting, but if the stock feeds into the grippers crooked, you should check to see if the pressure is even at both ends of the feed rollers. You can test the pressure by inserting two strips of 20-pound bond paper between the upper and lower feed rollers and turning the press until the upper roller drops down against the strips. Then try to withdraw the paper. There should be a firm, even pull on both strips, but it should not be so great that the paper will tear.

If one strip is held tighter than the other, loosen the lock screw (A), shown in figure 12-25, and turn the eccentric bearing (B), counterclockwise to increase the tension on the near end of the lower feed roller or clockwise to decrease it. In order to make this adjustment, it may be necessary to reduce the overall tension on the rollers. To reduce the overall tension, turn adjusting screw (A) in a clockwise direction. Reverse this operation to increase the overall tension. (See fig. 12-26.)

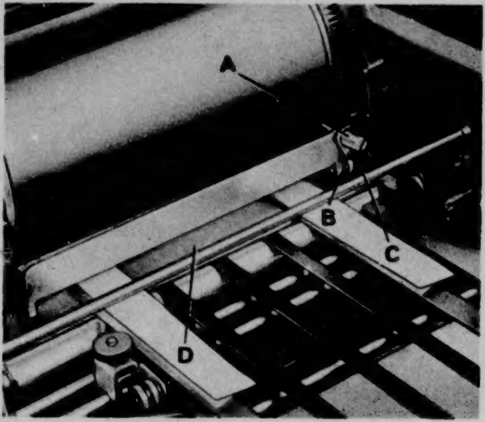
The front guides will seldom need adjustment. However, if they start to nick the paper as it is fed into the printing unit, it is an indication that they are not dropping far enough to clear the edge of the sheet. In this case, you can lower them slightly by loosening the locknut (B) and turning the adjusting screw (C) clockwise. (See fig. 12-26.) Always retighten locknuts after adjustments have been made.



57.750X

A. Lock screw
B. Eccentric bearing
C. Detent pawl

Figure 12-25.—Feed roller leveling adjustments are made here after removing the side plate on the operator's side of the press.



57.751X

A. Adjustment screw to adjust overall tension of the feed rollers
B. Lock nut
C. Adjustment screw to lower or raise the front guides
D. Plate

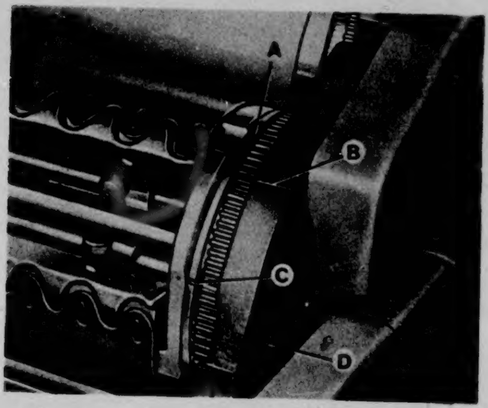
Figure 12-26.—Feed roller and front guide adjusting screws.

Cam Band Adjustment

If the upper feed roller does not rise and the front guides do not lower at the proper instant, the sheets will be out of register and they will overshoot or fail to enter the impression cylinder grippers. The timing of the feed roller and front guides is controlled by the cam band, which is located just inside the gear on the far side of the blanket cylinder. (See fig. 12-27.)

To check the adjustment of the cam, place a sheet of paper between the feed rollers squarely in contact with the front sheet guides. Turn the press handwheel counterclockwise so that the paper will start to feed through the press and into the impression cylinder grippers, as shown in fig. 12-28.

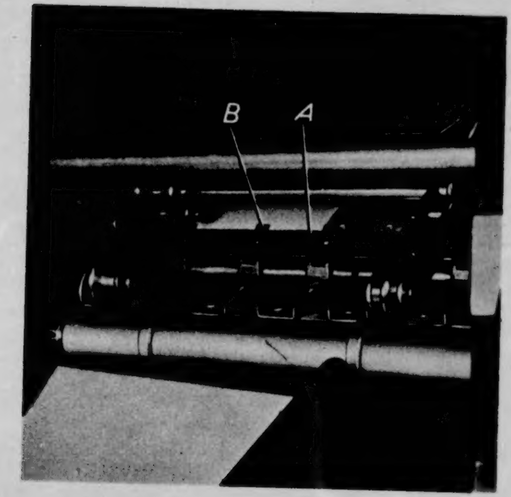
The cam is properly timed when the sheet is under the grippers and held firmly against the stop plates. If the sheets are under the grippers but not in contact with stop plates, the cam band must be advanced slightly. When the sheet is over the grippers or extends over the stop



57.261(57C)X

A. Cam band
B. Reference mark
C. Notch
D. Lock screw access hole

Figure 12-27.–The cam band controls the timing of the feed roller and front guides.



57.262X

A. Stop plate
B. Gripper

Figure 12-28.–The sheets must be firmly against the stop plate on the impression cylinder.

plates, the cam band must be retarded. When the press is actually operating, this condition will cause the sheets to flutter through the delivery end of the press.

The cam band is held in place by three lock screws on the end of the blanket cylinder. To adjust it, turn the press until the tail clamps of the blanket and plate cylinders are approxi mately one inch apart. Loosen two of the lock screws which are accessible through the holes (D) of the side plate, as shown in fig. 12-27. Next, turn the handwheel counterclockwise until the open part of the blanket cylinder is in line with the reference mark (B) on the side plate.

At this point, loosen the third lock screw so that the cam may be moved. Only slight movement, usually less than a 1/32", is necessary to adjust the cam band. To advance the cam, place a screwdriver in the notch (C) and move it toward the feeder end of the press. To retard the cam, move it toward the delivery end of the press.

Control Lever and Sheet Detector

Before you can begin printing you must place the single control lever, shown in fig. 12-4, in the "Print" position. This lever brings the dampener and ink form rollers in contact with the plate and also brings the plate cylinder into contact with the blanket cylinder.

The contact between the blanket and the impression cylinder (impression) is automatically controlled by a small metal finger located at the end of the feedboard just in front of the printing unit. When a sheet is fed into the press, it trips this detector finger to actuate the detent pawl (C), shown in figure 12-25, and throw on the impression. The impression remains off when no sheets are feeding through. You can put on the impression by hand by pushing the detent pawl toward the delivery end of the press and holding it while you rotate the machine.

AUTOMATIC COUNTER

The detent pawl also actuates the counter shown in figure 12-23. When the machine is in operation, the numbers on the counter change automatically with each impression so that you have a running record of the number of impressions made. At the beginning of a run, you should set the counter to 00000 by turning the notched wheel until the 5 zeros appear in opening.

DELIVERY UNIT

The basic Multilith 1250 press differs from larger offset presses in that it does not have a continuous chain delivery system. There is, however, an optional chain delivery system which will be discussed later.

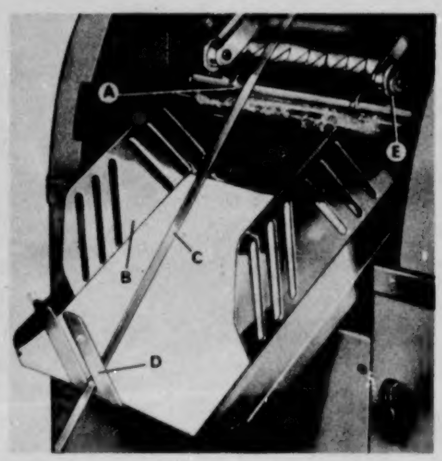
On models without the chain delivery, the sheets are ejected from the impression cylinder and pass through a set of rollers called the ejector rollers (E), shown in fig. 12-29, into a receiver tray.

The ejector rollers (E) are adjustable sidewise and are generally set along the outside edges of the sheet, since they are liable to smear the wet ink if they pass over the printed areas. The ejector rings (A), shown in the illustration, are also adjustable sidewise. You should position them inside the ejector rollers if the stock tends to curl up and outside the rollers if the stock curves down. To set the paper receiver, shown in figure 12-29, you should run a sheet through the press stopping just before the sheet is ejected. Then position the paper guides (B) so thst they will just clear the sides of the sheet when it is released. The back guide (D) may be set in any position that will allow the sheet to clear the ejector rollers when it is deposited in the paper receiver. The long steep strip (C) is known as the paper retainer. It directs the sheets into the receiving unit.

You will notice in figure 12-29, that a piece of tinsel is stretched across the delivery end of the press. Pressmen use this tinsel to remove static from the paper. You should keep a supply of it on hand and change it as it becomes worn.

CHAIN DELIVERY

A receding automatic delivery unit is attached to some Multilith presses you will operate. This unit consists of three gripper bars spaced on a chain system, a receding paper table, and automatic paper joggers.



57.263X

A. Ejector ring
B. Guide
C. Paper retainer
D. Back guide
E. Ejector roller

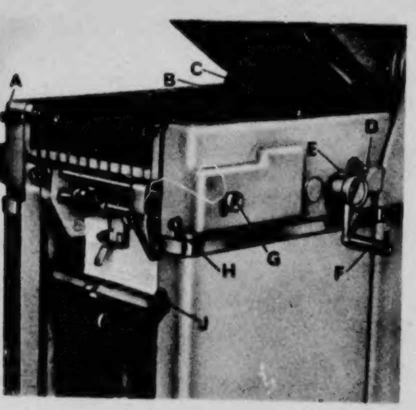
Figure 12-29.—Standard delivery unit.

The entire unit is covered with a wire safety screen to protect the operator from injury during press operation. The safety screen is interlocked to the electrical system of the press which prevents the press from running when the screen is up to enable adjustments to be made to the unit. Do not attempt to override this safety feature—it is installed for your protection.

The various controls for the chain delivery unit are shown in figure 12-30.

PRESS ADJUSTMENTS

There is no necessity for constant, fussy adjustments on any Multilith. The cams and parts which regulate the timing and registration are precision-built and factory set and you should not disturb them unless you are absolutely sure that a defective mechanical condition



A. Interlocking Safety Switch.
B. Start Lever for Paper Table.
C. Stop Lever for Paper Table.
D. High Speed Shaft for Crank.
E. Release Lever for Crank.
F. Crank for Paper Table – (on slow speed shaft).
G. Jogger Micrometer.
H. Paper Height Control.
J. Duplicator Speed Control.

57.752X

Figure 12-30.—Chain delivery unit controls.

exists. Ordinarily, you will find that most difficulties are caused by worn blankets; incorrect ink distribution; improper balance between ink and water; a poor plate; excessive pressure on ink or dampening rollers; or humidity.

When adjustments are necessary, they should be made by a person who is completely familiar with the press. The following paragraphs will describe most of the major adjustments on these presses, but remember that if the press is operating properly, you should leave it alone. Tinkering cuts down production and may eventually ruin your press.

Adjusting Ink Form Rollers

As you know, the Multilith is equipped with two ink form rollers which contact the plate and distribute ink to it. If these rollers are not parallel to the plate, the ink distribution will be uneven. You can check the form roller pressure by inking the press and then lowering the rollers into contact with a dry plate on the plate cylinder. If the rollers are correctly adjusted, they will leave an even, narrow stripe 1/8" to 3/16" across the plate. (See fig. 12-31.)

If either roller produces a stripe that is thicker at one end than the other or is larger or smaller than the measurement just mentioned, it must be adjusted.

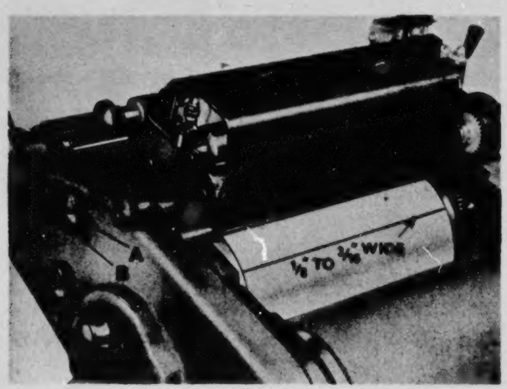
To adjust the overall pressure of the form rollers, loosen the set screw (A) and turn the eccentric shaft (B) with a screwdriver. Turning the shaft counterclockwise increases the roller pressure; clockwise decreases the pressure. (Note: The lock screw requires a bristo wrench, which is somewhat different from a common allen wrench. Those wrenches are included in a tool kit which is supplied with each press when it is purchased. If the bristo wrench has been misplaced, check with MR personnel for a replacement. Otherwise, the set screw will become stripped and you will be unable to loosen it.) Make sure that you retighten the set screw after adjusting the roller.

To parallel the ink form rollers set the night latch (C), shown in fig. 12-32, to the "Off" position and remove it and the side plate from the press.

The eccentric bearing (A), shown in the illustration, raises or lowers the far side of the form roller. Notice that each roller has an eccentric bearing. Loosen the lock screw and turn the bearing clockwise to raise the right (far) side of the roller. Turn the bearing counterclockwise to lower the right side of the roller. Retighten the set screw after adjusting the eccentric.

You will have to check the overall pressure of the rollers after making this adjustment. Follow the procedure described at the beginning of this section.

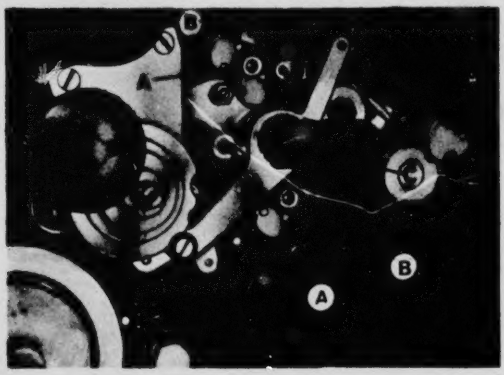
A third adjustment which must be made to the form rollers is roller end play. End play causes ink streaks. To relieve it, replace the night latch knob on its shaft and place it in the "On" position. Then loosen the lock screw (B), shown in fig. 12-32, and press the eccentric bearing (A) in as far as it will go. After this adjustment is made the roller must rotate freely on its shaft. Retighten the lock screw after making this adjustment. Replace the press side plate before operating the press.



57.266(57C)X

A. Set screw
B. Eccentric shaft

Figure 12-31.—Ink form adjustment procedure.



57.753X

A. Eccentric bearing
B. Lock screw

Figure 12-32.—Ink form roller leveling adjustment procedure.

Dampener Form Roller Adjustments

You can parallel the dampener form roller with the plate by a method similar to that just described. Drop the dampener form roller against the plate on two strips of bond paper and then check the tension on the strips. If the pull is uneven, loosen the setscrew (D), shown in figure 12-33, and turn the eccentric bearing (C) clockwise to reduce the pressure on the near side of the roller or counterclockwise to increase it. To increase the overall tension, loosen setscrew (B) then insert a screwdriver in the end of shaft (A) and turn counterclockwise. A clockwise turn of shaft (A) will reduce the overall tension.

If the dampener form roller develops end play, lift the roller from the plate and remove the idler roller. Then loosen setscrew (D) and push in on the eccentric bearing (C) until the play is removed. Retighten setscrew (D) to hold the eccentric bearing in position.

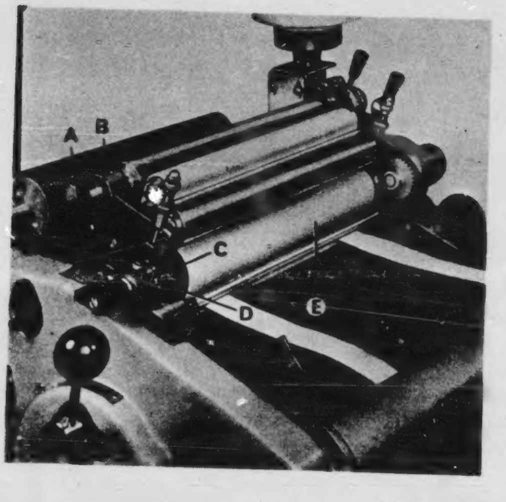
Adjusting Blanket-to-Plate Pressure

You can check the tension between the plate and blanket cylinders by a method similar to that used for checking the form roller tension. Put an old plate on the press and run it without water until it is inked solid. Then raise the form rollers, stop the press, and turn the cylinders until the plate is centered over the blanket. Next, bring the plate cylinder into contact with the plate by placing the control lever, shown in fig. 12-4, in the "Print" position. Raise the lever immediately to break contact between the cylinders and turn the handwheel until the inked line on the blanket cylinder is facing you. If the cylinder pressure is correct, the line should be 1/8" to 3/16" wide.

To adjust the pressure between the blanket and plate cylinders, loosen the lock nut (A), shown in figure 12-4. Move the control lever down to increase the pressure or raise it to decrease the pressure. After completing the adjustment, retighten the lock nut (A) and return the lever to the "Off" position. Before running the press recheck the blanket-to-plate tension.

Impression Cylinder Adjustments

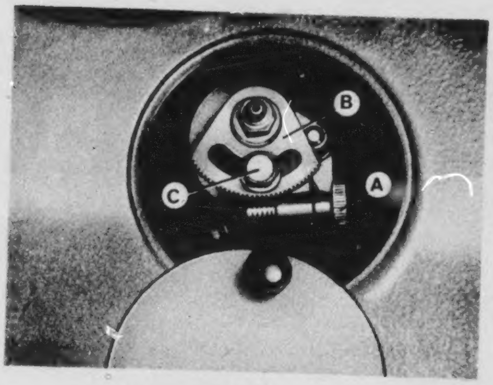
Occasionally, it is necessary to change the pressure between the impression cylinder and the blanket to accommodate different thicknesses of stock. You can do this by loosening the clamp screw (C) and adjusting the knurled worm screw (A), shown in figure 12-34. You can



57.267(57C)X

A. Roller shaft
B. Set screw
C. Eccentric bearing
D. Set screw
E. Form roller

Figure 12-33.–Dampener form roller adjustment procedure.



57.269X

A. Adjusting screw
B. Adjustment sector
C. Lock screw

Figure 12-34.–Impression cylinder pressure adjustment. A slightly different device that automatically compensates for various weights of paper is installed on some presses.

reach these screws through the covered opening on the near (operating) side of the press just below the handwheel.

In making this adjustment, you should loosen screw (C) and back off screw (A) one or two turns. Next turn the press by hand to move one of the stock sheets between the blanket and impression cylinders. Then turn screw (A) counterclockwise until it is snug. Give it another quarter turn to obtain the required "squeeze," and then retighten clamp screw (C).

Some models of the press are equipped with a compensating impression device that automatically adjusts to various weights of paper. If the press you are operating is equipped with this device, check the operator's manual or get help from an experienced operator before making any adjustments to it.

Leveling the Cylinder

Although such an adjustment is rarely necessary, if the printed sheet prints light on one side and all other adjustments are correct, it may be necessary for you to parallel the impression cylinder with the blanket cylinder.

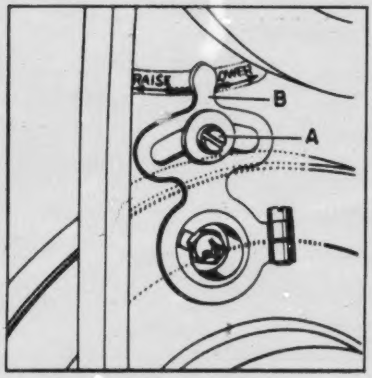
The diagram in figure 12-35 shows the leveling sector for the impression cylinder. You can see it through an opening in the casement on the far side of the press. However, it is necessary to remove the covering on the far side of the feedboard when adjusting it. After you remove the feedboard side plate, slip a screwdriver through the opening and loosen lock screw (A), shown in figure 12-35. Then move pointer (B) in the direction marked "raise" or "lower" to increase or decrease the printing pressure on the far side of the cylinder. Retighten lock screw (A) after the adjustment is completed.

MAINTENANCE

The life of your press depends on the care it receives. Proper lubrication and maintenance are two of the most important aspects of your job.

Insurance Is the Best Policy

It is best to oil the press according to the diagrams furnished by its manufacturer, but if



57.270X
Figure 12-35.—Leveling sector for paralleling impression cylinder and blanket cylinder.

such diagrams are not available, you can tell which parts need oiling by watching the press in operation. In general, you should oil any place where one moving part touches another part. You will find that if you mark the place with red paint, it will be easier for you to find it for subsequent oilings. Watch carefully for hidden oil holes, as they are easily overlooked. You will find many of these in the feeder, particularly in the elevating mechanism and the push bar which operates the side guides.

Always begin at the same place and work all the way around the press. Wipe off excess oil with a rag; don't allow it to drip or run down the side of the machine.

You should oil all oil holes every day with SAE No. 30 oil. Fill the oil reservoirs on the vacuum pump daily or as required. Oil all moving parts not provided with oil holes with a drop of oil once a day.

Grease-packed needle or ball bearings should be repacked with grease at regular intervals. Put grease on all chains and gears once a week. Grease bearings on the form rollers once each week.

Cleaning Ink Rollers and Fountain

At the end of the day, you should remove as much ink as possible from the fountain with an ink knife (palette). Then remove the fountain for further cleaning. To remove the fountain, you simply raise it to the position shown in figure 12-36, then lift it out of the press. Reverse this process to replace it. Clean the fountain with roller wash.

To facilitate the cleaning of the fountain, many operators place a fountain liner (a sheet of adhesive-backed paper cut to the proper shape) in the fountain before they apply the ink. This liner can be removed and thrown away when the press is washed up and a new one can be inserted before ink is placed in the fountain again.

You can clean the rollers without removing them from the press by using "cleaner sheets" on the plate cylinder. These sheets consist of blotter-like stock that clamp on the cylinder much the same as a plate. Once the cleaner sheet is in place, drop the form rollers on the cylinder and run the press while pouring solvent over the rollers from an oil can. The solvent will loosen the ink and it will be absorbed by the cleaner sheet.

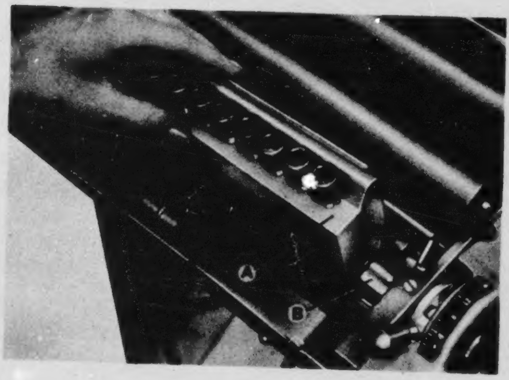
When the first cleaner sheet is saturated with ink, replace it with another. The rollers will generally be clean after the third sheet has been run. You can use each cleaner sheet twice by allowing it to dry and then using the clean side when you wash the press the next time.

After long use, the ink rollers will become glazed with dried ink. You can remove this glaze from the rollers by soaking them in a solution of lye water and then rubbing them down with pumice powder and blanket or roller wash.

When replacing the rollers, insert the two form rollers first. It is necessary to pull out on the eccentric shafts (B), shown in figure 12-37, when removing or replacing these rollers. You will find a punch mark on the end bearing of one of the form rollers and two punch marks on the end bearing of the other. The roller with the double punch mark should go in the lower position and the punched end should be placed on the near side of the press.

As soon as the form rollers are in place, turn the press until the ductor roller bracket is midway between the fountain roller and the fixed distributing roller and insert the ductor. Secure the ductor roller with the spring latches at each end.

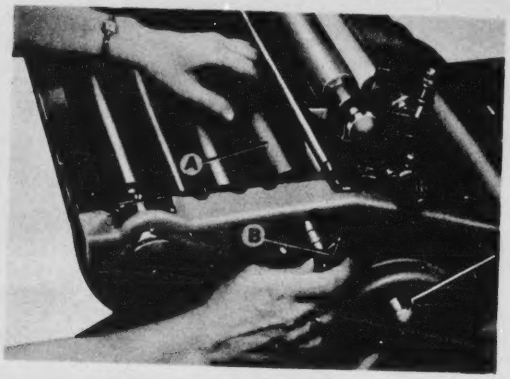
Finally slip the three idler rollers, and then, the upper distributing roller into their slots.



A. Ink fountain
B. Fountain roller shaft

57.271(57C)X

Figure 12-36.–Lifting the ink fountain from the press.



57.754X

A. Form roller
B. Form roller shaft

Figure 12-37.–Ink form roller removal procedure. The upper shaft has one punch mark at the bearing end; the lower shaft has two punch marks on it. Ensure that the shafts are correctly placed in the press by checking the punch marks before replacing the rollers.

Cleaning the Dampener Rollers

You should remove the water from the fountain at the end of each day. If the fountain roller becomes coated with ink, clean it with pumice powder and water. Coat it with a desensitizing etch at regular intervals.

You can clean molleton-covered dampeners with water. If they are extremely dirty, you should take them out of the press and clean them with roller wash and water, or with a good detergent.

Saturate the dampers with water so that the cleaner will not soak into their covers; then scrub the rollers with a stiff brush and a detergent solution. Rinse well in warm water and allow the dampener to dry overnight. If there is much ink on the surface of the molleton, you should scrape the dampener with a metal blade before applying the cleaning solution.

You should change molleton covers when they get too dirty to do their work effectively. New covers are generally supplied in the form of open-end sleeves. Remove the old cover; then slip this seamless tubing over the roller and sew up the ends with a needle and thread.

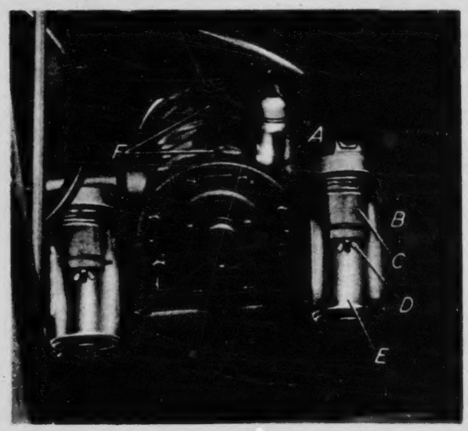
Blanket Care

You have already seen that a new blanket should be washed thoroughly with lithotine or a suitable solvent to remove the bloom before it is put on the press. To remove dried ink or glaze from a blanket, you should scrub it with pumice powder and blanket wash; then powder the blanket with talcum powder.

If the blanket becomes soft and tacky or embossed to the point where powdering does not help, remove it from the press. Then clean and powder it well and store it in a cool, dark place for a week or two. It will then be ready to use again.

Vacuum Pump Maintenance

Once a week, you should remove the caps (F), shown in figure 12-38, and oil the vacuum pump bearings. The rest of the pump is lubricated automatically by the reservoir (A). Keep this



57.275X

A. Oil reservoir hole
B. Cap
C. Filter
D. Lock nut
E. Filter jar
F. Bearing oil caps

Figure 12-38.—Vacuum pump.

reservoir filled with oil. When the press is in operation, oil gradually collects in the glass jar on the blower side of the pump. You should clean this jar at regular intervals.

You should also clean the filters (C) at regular intervals. Unscrew the glass jars from their holders and remove the wing nuts and washers which hold the filters. Then soak the filters in blanket wash; allow them to drain dry; and replace them.

STEP-BY-STEP OPERATIONS

1. At the beginning of the day or at regular intervals, clean and lubricate the press.

2. At the beginning of the day, put ink in fountain and run press to distribute ink over the rollers. (Release night latch (C), shown in figure 12-7, before starting the press.)

3. Mix fountain solution and fill fountain and reservoir. Run press to distribute solution over rollers. Use sponge, if necessary.

4. Examine plate and mount on cylinder. Sponge with water.

5. Start press by flipping switch up. Drop dampener and ink form rollers by placing knobs to delivery end of press. Move single lever control to "Moist"; hold there for several revolutions. Move single lever control to "Ink"; hold there for several revolutions. Replace lever to "Off". Stop press and examine plate.

6. If plate in inking properly, sponge again; turn on the press; drop dampeners and ink rollers.

7. Turn operating control lever to bring plate into contact with blanket. Raise rollers and stop press after two or three revolutions.

8. Make pencil mark at the top of a sheet of stock to be run to indicate amount of space to be allowed for left margin. Match this mark against left edge of image on plate. Measure distance from left edge of plate to left edge of sheet. Use this measurement in setting side guide along the locating scale.

9. Turn press until left side guide is at the end of its inward thrust. Then set guide to position along locating scale that corresponds to distance from left edge of plate to left edge of sheet.

10. Place a sheet of stock to be run on the conveyor tapes at end of the feedboard. Press spring clamp and move right side guide in until it contacts right edge of sheet and presses paper against the left side guide with a slight pressure.

11. Lower feed table. Set piling bars, using feed table scale.

12. Load stock onto feed table and raise table until top of paper stack is 1/4 inch below the separator fingers. Set back paper stop and paper guides to back and side edges of stack.

13. Set caliper and adjust sheet controls on feedboard, if necessary.

14. Turn press by hand to run sheet through feeder and check settings.

15. Stop press before sheet is delivered. Set ejector rollers, ejector rings, and paper guides in delivery unit, if necessary.

16. Sponge plate; start press; drop rollers; turn on vacuum to start sheets feeding through.

17. Place single lever control in "Print" position.

18. After 3 or 4 sheets have been run through, shut off air; place single control lever in "Off" position. Shut off press.

19. Check image on sheet for position.
    a. If image is not centered sidewise, make small adjustments with micrometer screw on left side guide or move left side guide, as required. (If movement of side guide is excessive, it may be necessary to change setting of feeder and delivery units, also.)
    b. If image is too high or too low, loosen bolt on end of plate cylinder and move undercut section of cylinder, as required. Wash blanket before pulling another impression.
    c. If image is crooked on sheet, make minor adjustment by paralleling left side guide to paper with the adjusting screw (C) shown in figure 12-17. If large adjustment is necessary, twist plate on cylinder by turning the notched adjusting screws (in cylinder gap) in opposite directions. Wash blanket before pulling another impression.

20. Check for proper ink distribution. Adjust ink and water if necessary.

21. Check for spots that are not printing properly. If these spots are due to a worn or damaged blanket, change blanket or underlay low areas with strips of paper.

22. Sponge plate; start press, run several more sheets until ink and water are balanced.

23. Set counter at 00000 and proceed with run.

24. Examine work at regular intervals. Remove sheet from delivery pile about every 50 or 100 impressions. Watch ink distribution. Adjust water and ink, as necessary.

25. Reload feeder as stock is depleted; remove sheets from delivery unit after each 500 or 600 impressions. Stack printed sheets on a table.

26. After run is completed, stop press; transfer plate to table.

27. If plates are to be saved, go over metal plates with gum arabic solution; go over direct image and presensitized plates with preservative solution recommended by plate manufacturer. Rub dry and store away.

28. Wash blanket and prepare press for next plate.

29. At the end of the day, remove all ink from the fountain. Clean rollers, dampeners, and blanket. Remove fountain solution from water fountain. Wash ink fountain and rollers with roller wash or other solvent. Wash blanket with blanket wash. Throw night latch to relieve tension on ink form rollers.

RUNNING HEAVY STOCK

It will be necessary for you to make a few simple adjustments to the press when you are running cardboards and heavy stocks.

Besides adjusting the suction and blast, the caliper, and the pile height bar, it may be necessary for you to remove the sheet separator finger, and to reset the upper feed roller. In addition, it may be necessary to change the pressure between the blanket and impression cylinder to accommodate the new thickness of stock.

If the stock is very thick, you should replace the regular blanket with an old one, as thick stock sometimes damages the blanket.

CHAPTER 13

THE A.B. DICK OFFSET DUPLICATOR, MODEL 350

INTRODUCTION

The A. B. Dick Offset Duplicator, model 350 has a maximum printing area of 9 1/2" X 13" and will take a sheet as large as 11" X 17" or as small as 3" X 5".

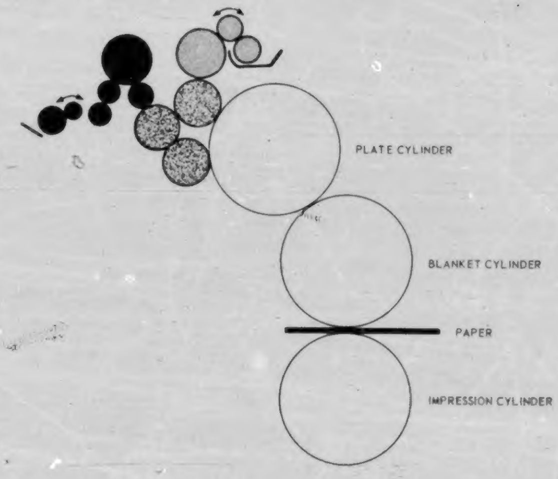
As you have seen in chapter 11, the dampening system on this press differs from that found on most small offset presses in that the water and ink are both fed to the plate from the same set of form rollers. When the press is in operation, the ink is distributed over ALL the rollers, including those in the dampening system. The fountain solution, in turn, is distributed not only to the rollers in the dampening system, but also to some of the ink rollers, as shown in figure 13-1. Thus, the ink form rollers are covered with a film of water, as well as with a layer of ink. As the plate cylinder travels under these rollers, the rollers give up their moisture to the non-printing areas of the plate and transfer the ink to the ink-receptive image areas.

Although the A. B. Dick Company produces a line of inks, fountain solutions, and other supplies specially formulated for use with their equipment, any good ink or fountain solution can be used on these presses without creating problems of emulsification.

OPERATOR'S CONTROLS

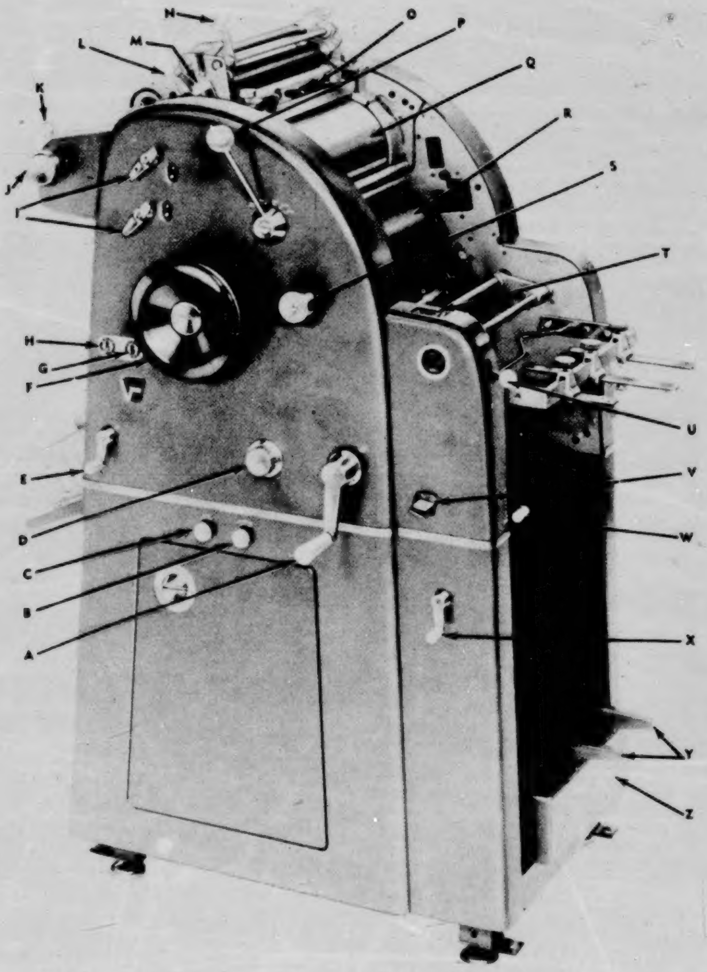
The locations of the operator's controls are shown in figure 13-2. The press On-Off switch (H) and the vacuum pump switch (G) are located just forward of the handwheel (F). Continuous feeder operation is started by raising the paper feed control lever (U). Later models of the press are equipped with an operation control lever (P).

As you can see in figure 13-3, the operation control lever can be shifted into five positions. In the extreme left position (toward the delivery end of the press) the lever relieves tension on the ink form rollers. This position is referred to as the "night latch" position; it is used during long periods of downtime, such as between shifts or overnight. Moving the lever to the "neutral" position breaks contact between the ink form rollers and plate cylinder when the press is idling (running but not actually printing). When the lever is in "ink" position the form rollers are in contact with the plate. Moving the lever to "image" position brings the plate and blanket cylinders into contact and transfers the printing image to the rubber blanket. When you hold the lever in the extreme right position (toward the



57.307X

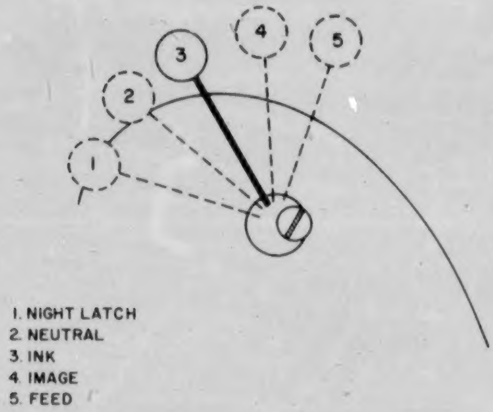
Figure 13-1.—Diagram of the inking and dampening system rollers on an A. B. Dick offset duplicator. When the press is in operation, ink is distributed to all rollers including those in the dampening system. Water is distributed over the ink form rollers and lower ink oscillator as well as over the dampening system rollers.



A. Crank for raising and lowering feed table.
B. Suction control knob. Clockwise turn increases suction.
C. Blast control knob. Clockwise turn increases blast.
D. Buckle control knob.
E. Speed control handle.
F. Handwheel for turning press by hand.
G. Switch for vacuum pump.
H. Switch for turning on press.
I. Handles for raising and lowering form rollers.
J. Knob for turning fountain roller by hand.
K. Ink fountain control lever. Controls ink feed.
L. Aquamatic lock-out latch.
M. Aquamatic control lever controls water feed.
N. Aquamatic night latch handle.
O. Aquamatic fountain.
P. Operation control lever. Also called the activator lever.
Q. Plate cylinder.
R. Blanket cylinder.
S. Locking lever (built-in wrench) used in raising or lowering image on sheet.
T. Counter.
U. Paper feed lever. Raise to start sheets feeding
V. Table release. Depress when lowering feed table.
W. Lever for regulating height of paper stack.
X. Handle used in moving left piling bar at front of feed table.
Y. Paper supports.
Z. Feed table.

57.309(57B)X

Figure 13-2.—Operator's controls.



57.755

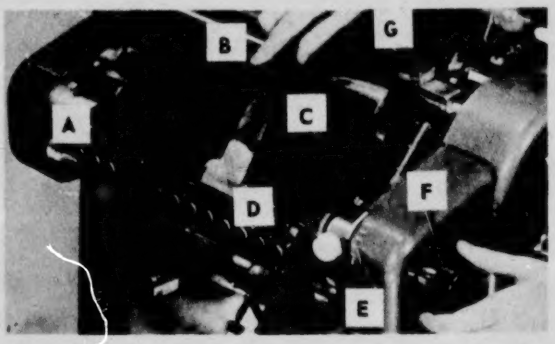
Figure 13-3.—The five positions of the operation control lever.

feeder end of the press) sheets feed into the press. When the lever is released, it automatically returns to the "ink" position and the paper feeder stops. This feature enables you to have positive control of the feeder whenever you need only one or two sheets, such as during makeready operations, or when you want to check the sheets after making an adjustment during the press run. Normal feeder operation is started by raising the paper feed lever (U), shown in figure 13-2.

INKING UNIT

As you can see in figure 13-1 the inking unit on this press consists of an ink fountain, fountain roller, ductor, 2 oscillators, 3 distributors, 2 form rollers, and various operating controls.

The ink supply is regulated by the conventional thumbscrews on the fountain and by the setting of the ink fountain control lever (D) along the scale (E), shown in figure 13-4. You should move this lever toward the feeder end of the press (toward No. 4 on the scale) to increase the ink supply, and move it in the opposite direction to decrease the supply. When the lever is moved to the position marked "off", the fountain roller ceases to turn and the ink feed is shut off completely.



A. **Fountain keys.**
B. **Ductor roller.**
C. **Fountain roller.**
D. **Ink fountain control lever.**
E. **Scale for lever (D).**
F. **Knob for turning fountain roller by hand.**
G. **Roller rest. Place aquamatic oscillator roller on this bracket during long shut-down periods.**

57.308(57B)X

Figure 13-4.—Inking unit.

The knob (F) is for turning the fountain roller by hand when you are setting the fountain keys at the beginning of the day or when you wish to increase the supply of ink momentarily during the run. It should be turned only in a counterclockwise direction. The handles (I), shown in figure 13-2 are for raising and lowering the form rollers.

Once you have lowered the form rollers at the beginning of the day, it is not necessary to raise them with handles (I) each time you shut down the press. Instead, you can simply move the operation control lever (P) shown in figure 13-2 to the "neutral" position.

Older models of the press are not equipped with an operation control lever. On these models, it is necessary to use the handles (I) each time you wish to raise or lower the form rollers. On the older presses, you will find a night latch lever on the far side of the press. You should move it to the position marked "night latch" when you shut down the press for a long period of time.

The cylinders are normally out of contact with one another when no stock is feeding through the press. However, on the older models of the press, you can use the lever (C) shown in figure 13-5 to build up the image on the blanket before you start the feeder. When you push this lever down, it causes the plate cylinder to lower against the blanket without moving the impression cylinder against the blanket. You should hold lever (C) down for three or four revolutions of the press to build up the image on the blanket before you start the feeder so that you will have a good print on the first sheet fed through. Spring tension will cause the lever to return to its original position as soon as you release it.

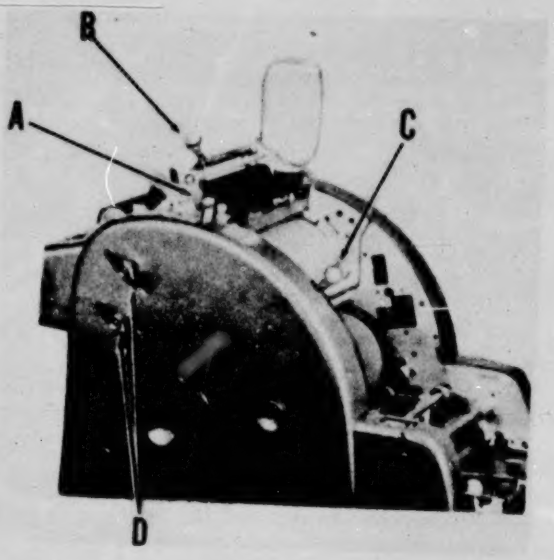
AQUAMATIC UNIT

The dampening unit of this press is called the aquamatic unit. It consists of a fountain, a bottle that acts as a reservoir for the fountain solution, a metal fountain roller, a rubber composition ductor roller, and a hard rubber oscillating roller. None of these rollers require molleton or paper covers, like those used on the rollers in conventional dampening systems.

Figure 13-6 shows the operating controls for the aquamatic unit. You can regulate the water supply by moving the aquamatic control lever (C) along the scale on the press frame. Moving the lever toward the higher numbers increases the flow and vice versa. The lever is generally set at No. 45 on the scale to provide the maximum water supply during make-ready operations at the beginning of the day, and is later moved back to 20 or 25 when the run actually begins. Of course, this setting varies with the speed of the press or the type of paper or ink being used. You can shut off the water supply completely by moving the lever all the way back to the position marked "off."

The night latch (B), shown in figure 13-6, is used to free the aquamatic ductor roller when the press is shut down. Push the lever toward the feeder end of the press to raise the ductor and push it in the opposite direction to bring the ductor back into operating position.

As you will see later, the aquamatic oscillator roller is generally lifted from the press and placed on the support bracket (G), shown in figure 13-4, during long shut-down periods. This roller must be replaced and the night latch must be moved to its operating position before the press is started again, of course. When replacing the roller, fit the hole on the far end of the shaft over the drive pin and slip the other end of the shaft into the slide guides.



A. Aquamatic control lever.
B. Night latch for aquamatic rollers.
C. Knob for building up image on blanket when no sheets are feeding through.
D. Handles for raising and lowering form rollers.

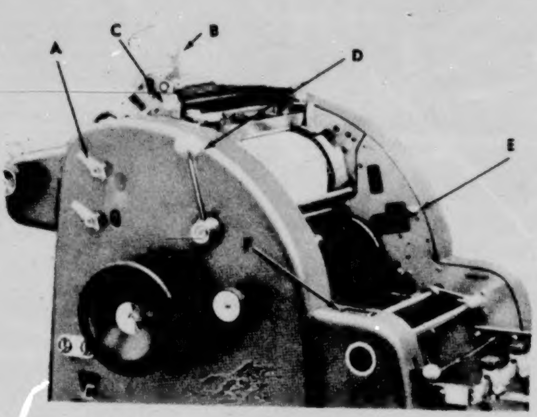
57.310X

Figure 13-5.—Operator's controls on earlier models of press.

The aquamatic lock-out latch (L), shown in figure 13-2, is designed to prevent extra water from backing into the inking system when the press is turned backwards. You should keep it in its down position (toward the delivery end of the press) at all times except during morning makeready and wash-up operations. This lever is not found on older models of the press.

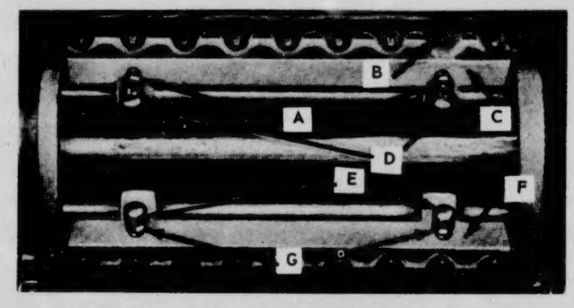
BLANKET CYLINDER

As you can see in figure 13-7, the blanket is attached to hook bars which can be moved to or away from the edge of the blanket cylinder with



A. Handles for raising and lowering form rollers.
B. Night latch for aquamatic rollers. Move to right to throw on.
C. Aquamatic control lever. Move to right to increase water supply.
D. Operation control lever.
E. Adjusting screw for blanket to plate cylinder pressure.
F. Counter

57.310(57B)X
Figure 13-6.—Aquamatic controls on late models of press.



A. LOCKNUTS FOR ADJUSTING SCREW (D).
B. HOOKS.
C. UPPER OR LEAD HOOK BAR.
D. THUMBSCREWS FOR MOVING HOOK BAR (C) TO OR AWAY FROM SURFACE OF CYLINDER.
E. THUMBSCREWS FOR MOVING HOOK BAR (F) TO OR AWAY FROM SURFACE OF CYLINDER.
F. LOWER OR TAIL HOOK BAR.
G. LOCKNUTS FOR ADJUSTING SCREWS (E).

57.311(57B)X
Figure 13-7.—Blanket cylinder adjustments.

the thumbscrews (D) and (E). You should loosen locknuts (A) and (G) and move the hook bars in with thumbscrews (D) and (E) when removing the old blanket.

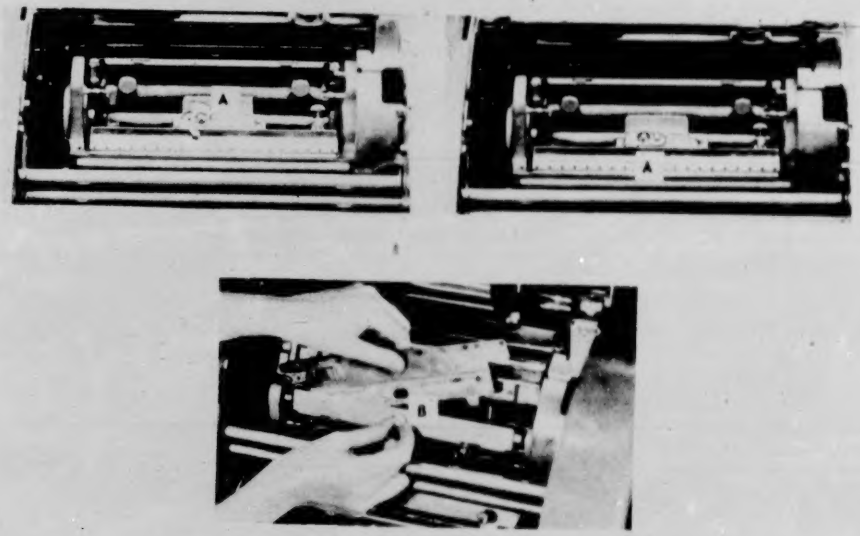
Once the old blanket is removed, you should turn thumbscrews (D) until the upper hook bar (C) is approximately one-half inch from the edge of the cylinder. Then attach the lead edge of the blanket to the upper hook bar and turn the press by hand to draw the blanket around the cylinder. When you reach the cylinder gap again, attach the other end of the blanket to the lower hook bar (F) and tighten thumbscrews (D) and (E) until they are snug. Retighten the locknuts to hold the thumbscrews in place and run 200 to 300 impressions. Then loosen the locknuts and tighten the thumbscrews again with your fingers, if necessary.

PLATE CYLINDER

Since the plate cylinder on this press is equipped with interchangeable plate clamps, it can handle any type of plate. Slotted or serrated plates use one type of clamp and pinbar plates require another. Straight-edge masters can be used with either type of clamp.

Figure 13-8 shows the steps involved in changing from one type of clamp to another. To change the head clamp, turn lever (A) clockwise to the position shown in the illustration. This will release the head clamp and you can remove it and mount the alternate head clamp in its place. Lock the new clamp in place by moving lever (A) back to its original position, as shown in the illustration.

Only the inside section of the tail clamp is removable. To remove this section, you should hold the clamp open with your left hand; then push in on knob (B) and turn the knob clockwise one quarter of a turn. Reverse this process to lock the alternate section in place.



57.313(57B)X
Figure 13-8.—Plate cylinder is equipped with interchangeable head (above) and tail (lower) clamps.

Mounting the Plate

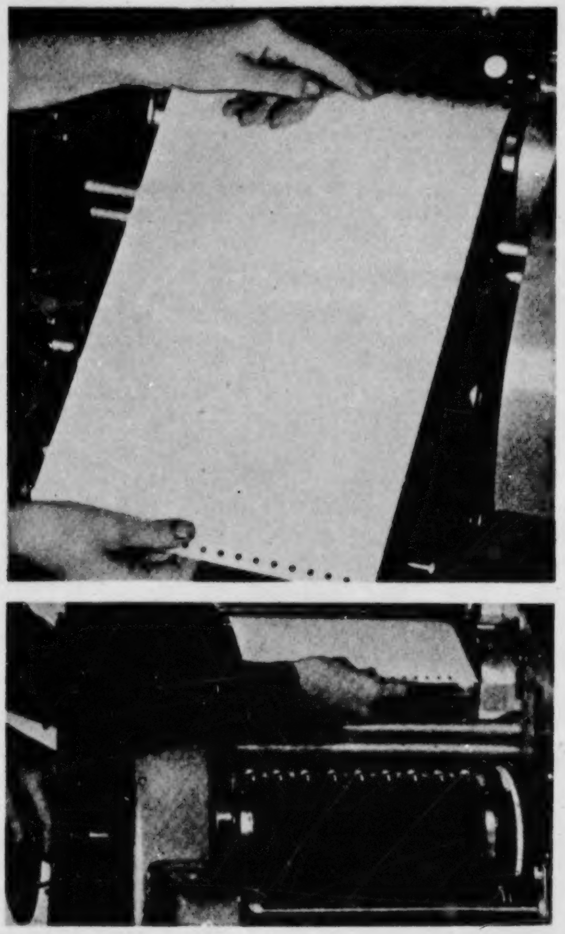
Figure 13-9 shows the steps involved in mounting a slotted plate on the press. Attach the gripper or lead edge of the plate to the head clamp (bottom row of hooks). Crease or bend the plate slightly along the edge of the cylinder so that it will fit the contour of the cylinder, and then turn the press to draw the plate around the cylinder. When you reach the cylinder gap again, raise the tail clamp enough to enable you to slip the other end of the plate over the upper row of hooks. Move the locking lever (A), shown in figure 13-10 toward the near side of the press to lock the clamp. Spring tension will hold paper plates taut, but you should tighten the tail clamp slightly with the two thumbscrews (B) if you are running metal plates or if close register is involved.

You have just seen that straight-edge masters will fit under any type of clamp. To mount a straight-edge plate on the cylinder, you should press lever (A), shown in figure 13-11, to open the clamp, and then insert the gripper edge of the plate into the clamp against the stops (B). Close the clamp with locking lever (C), crease the plate along the cylinder edge, and turn the press to draw the plate around the cylinder. Raise the tail clamp slightly and insert the tail end of the plate into the clamp. Perforate the edge of the master with the teeth of the clamp. Then close the clamp and lock it by moving the locking lever (A) shown in figure 13-10, toward the near side of the press.

Image Adjustments

There are two adjustments to the plate cylinder head clamp that change the position of the image on the press sheet. If the image is not positioned correctly side-to-side, you can make a slight adjustment (up to ¼″) by turning the knurled knob (B), shown in figure 13-12. When the side-to-side adjustment is greater than ¼″, you must move the paper pile and change the feeder set-up.

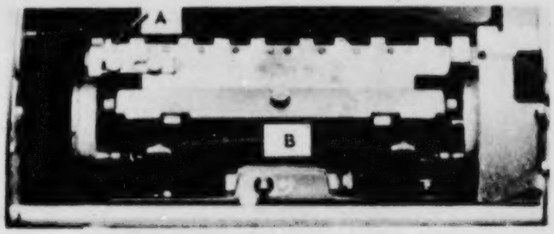
When the image is printing crooked on the press sheet, you can correct it by turning the knurled knob (A), shown in figure 13-12. If the image is down from right to left, turn the knob counterclockwise to straighten it. If the image is running upward from left to right, turn the knob clockwise to straighten it. When you are using straight edge plates, you can adjust the image on



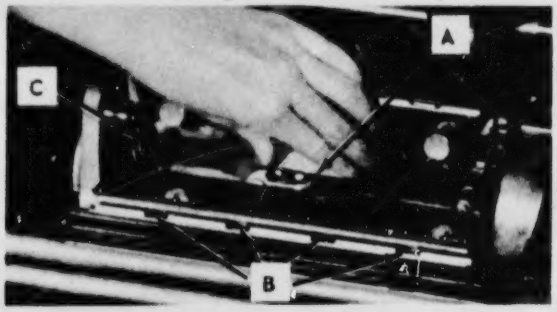
57.314(57B)X
Figure 13-9.—Mounting a plate on the press.

the press sheet by releasing the plate head clamp and moving the plate in the desired direction.

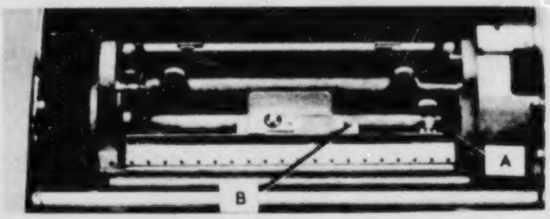
If the image prints too high or too low on the sheet, you can reposition it by moving the impression cylinder. To do this, you must turn the press until the locknut (C) on the near end of the blanket cylinder is aligned with the built-in wrench (A), shown in figure 13-13. Press wrench (A) in and turn it counterclockwise to loosen the locknut and continue to hold it so that the blanket cylinder will not turn while you rotate the press by hand to move scale (D) in the direction marked "raise" or "lower". There are two sets of gears at the far end of the blanket



57.315(57B)X
Figure 13-10.—Tail clamp adjustments.

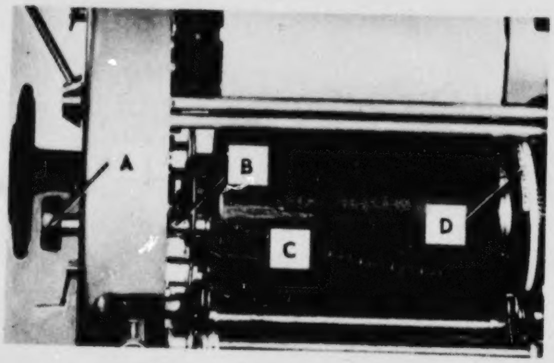


57.316X
Figure 13-11.—Head clamp on plate cylinder. Press lever (A) to open clamp when mounting a straight-edge plate. Insert plate against stops (B) and close with lever (C).



A. Knurled knob for straightening image.
B. Knurled knob for shifting image sidewise.

57.317(57B)X
Figure 13-12.—Image adjustment controls located on the plate cylinder head clamp.



A. Locking lever (built-in wrench). Push in and turn counterclockwise to release locknut(C).
B. Lock or socket on end of lever (A).
C. Locknut.
D. Scale.

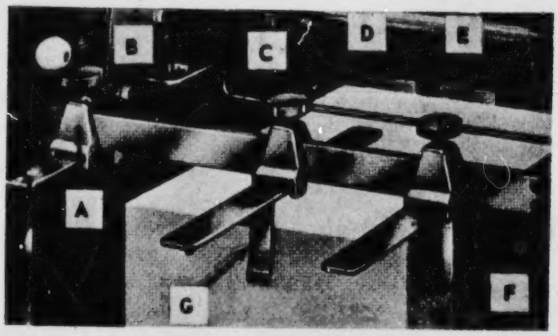
57.318(57B)X
Figure 13-13.—Vertical (up-down) adjustment controls.

cylinder but only the outer gear moves when this adjustment is made. The outer gear works with the impression cylinder gear to move the impression cylinder forward or backward. Since the plate and blanket cylinders are geared together with a separate set of gears, the relationship between the plate and blanket cylinders does not change. This makes it unnecessary for you to wash the blanket before pulling another proof.

After the adjustment has been made, turn wrench (A) clockwise to retighten locknut (C); then release it. Spring tension will cause the wrench to return to its original position when it is released.

AUTOMATIC FEEDER

The feeder on this press is different from that found on other presses in that the stock is fed directly from the feed table into the printing unit. This press has no feedboard, no conveyor tapes, no moving side guides, and no front guides.

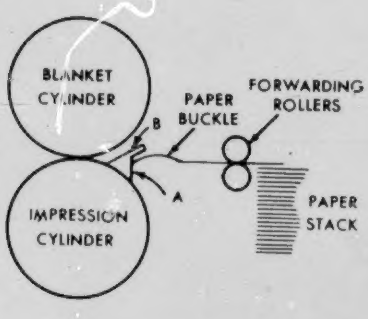


57.319(57B)X
Figure 13-14.—Feed table controls.

If you will study figure 13-14 for a moment, you will see how the feeder works. The piling bars (D) are similar to those already discussed. They are positioned along a scale at the front of the feed table and they guide the stock as it is forwarded into the printing unit.

The guide (A), shown in the illustration, is equipped with a steel spring which forces the top sheets in the pile against guide (F). Guide (F) acts as the registering guide. Guides (F) and (A) are interchangeable so that you can register the sheets from either side of the press.

When the press is in operation, four blower tubes at the front of the stack float the top sheet in the pile and the spring on guide (A) forces the sheet against guide (F) and the right front piling bar to register it sidewise. Four sucker feet then dip down and catch the front edge of the sheet and move it under a set of rubber forwarding rollers which are travelling against a lower knurled metal roller. The forwarding rollers force the paper directly into the cylinder grippers, as shown in figure 13-15. As the cylinder grippers open to receive the sheet, the paper stops (A) rise from recess in the impression cylinder and the paper is forced against these stops in much the same manner as the paper is registered against the front stops on the conventional feeder. Since the paper can go no further after it reaches these stops, it forms a slight buckle before it is drawn into the printing unit. This buckle (overfeed) has an important



A. Stop.
B. Gripper.

57.320X
Figure 13-15.—Diagram showing how top sheet buckles as it feeds into the gripper stop.

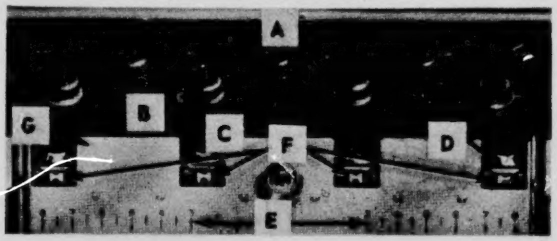
effect on registration. If there is too much buckle, the stock may be nicked along the edge, and if there is not enough, there may be insufficient gripper bite on the edge of the sheet.

As you will see later, you can regulate the amount of buckle with the knob (D) shown in figure 13-2. This knob changes the feeder timing by moving the sucker feet slightly forward or backward, thus controlling the distance the sheet is fed into the grippers in the allotted time.

Setting the Feeder

You can move the left piling bar sidewise by turning the handle (X), shown in figure 13-2 and you can set the right piling bar by turning a similar handle on the far side of the press.

If you wish to register to the right side, you should move the right piling bar to the position on scale (E), shown in figure 13-16, that corresponds to the width of the stock being run. If the stock is 8 inches wide, for example, you should turn the crank until the piling bar is positioned at 8 on the scale. The other piling bar should be set to just clear the edge of the stock. You should reverse this procedure if you wish to register the sheet to the left, of course.



57.322(57B)X
Figure 13-16.—Feeder unit components.

Next lower the feed table by pressing the crank (A) in to engage the gear and turning it counterclockwise while you depress lever (V), shown in figure 13-2.

Move the paper stack supports (Y) shown in figure 13-2, if necessary, so that they will clear the pile back stop (G), shown in figure 13-14, as the last sheets are fed into the press and the feed table rises to its maximum height. The flanges on the supports should be on the outside, as shown in figure 13-2. You can cover the supports with a metal plate or a piece of cardboard cut slightly smaller than the stock to be run. This will act as a support for the paper.

After the stock has been loaded, you should raise the feed table until the top of the stack contacts the four paper height regulators (F) shown in figure 13-16, when the regulators are in their lowest position. Then pull out the crank to disengage it. (It may be necessary to turn the press to move the regulators to their lowest position.) Square the top sheets of the pile against the front plate (G) shown in figure 13-16, and the piling guide on the register side and then set the paper guides (A, F, and G), shown in figure 13-14.

If you are registering to the right side, set guide (F) against the side of the stock about 2 inches from the tail edge of the pile. Center guide (A) with the left edge of the stock and move it in until the spring contacts the stock and is depressed by about one-eighth of an inch. Reverse the positions of guides (A) and (F) if you are registering to the left. You should remove the screws and reverse the position of the spring when you change guide (A) from one side of the feed table to the other. (See fig. 13-17.)

Set the backstop (G), shown in figure 13-14, to press lightly against the back of the pile if you are running thin or medium weight stock. Set it to allow a slight clearance between the stop and the pile when you are running heavy stock.

Paper Weight

The paper weight (B), shown in figure 13-18, is a wire bail that controls the sheet as it is floated by the blowers. There are four holes or positions for this wire. You should place it in the position nearest the forwarding rollers when you are running lightweight stocks, and move it back for heavier stocks. You may find it necessary to remove the wire entirely when you are running card stocks.

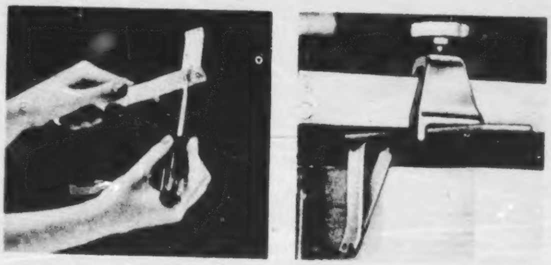
This press may be equipped with an extra bail made of lighter gage wire which is used instead of the standard bail when lightweight stocks are run.

Pile Height Control

The pile height regulators (F), shown in figure 13-16, move up and down when the press is in operation. As the paper is fed into the machine, they move lower and lower until they finally allow a pawl to engage and turn an elevating ratchet which raises the feed table. This keeps the height of the stack constant as the paper is fed into the press.

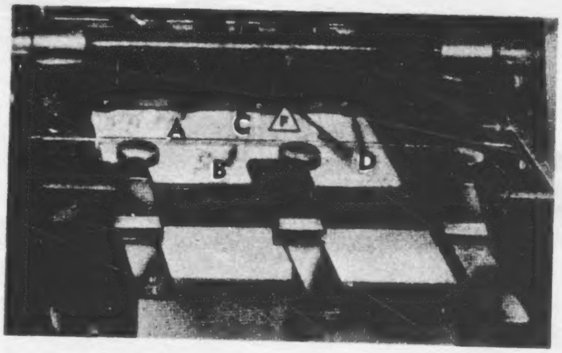
You can make the stack run higher or lower with the lever (W) shown in figure 13-2. Most operators set the lever at 3 to 6 on the scale for 20-to 60-pound stock. They run the stack slightly higher when they are running heavy stock and lower it when running lightweight stocks.

On the older models of the press, you will find a pile height control knob in place of the lever. A clockwise turn of the knob causes the stack to run lower and vice versa.



57.323(57B)X

Figure 13-17.–The spring guide is reversable to permit you to register from either the right or left side of the pile.



A. SUCKER FEET.
B. PAPER WEIGHT.
C. PAPER LEVELERS.
D. PILE HEIGHT REGULATORS.

57.324(57B)X

Figure 13-18.–Feeder unit suction feet and paper leveler positions for a standard width sheet.

Paper Levelers

As you can see in figure 13-18, there are four sucker feet (A) and three paper levelers (C) which contact the front edge of the stack. The paper levelers help prevent double sheeting and assist in feeding curled or lightweight stocks. You can raise or lower them as necessary. You should set them slightly higher than the suction feet (when the suckers are all the way down) when you are running card stock and slightly lower than the sucker feet when you are running other kinds of stock. The paper levelers are attached to the same bar as the sucker feet and are interchangeable with the feet. Older models of the press do not have the paper levelers.

Sucker Feet

The sucker feet and paper levelers are attached to a cam-operated suction tube that swings back and forth when the press is in operation alternately carrying the feet down to the top of the stack where the suction goes on to pick up the sheet, and up again to the forwarding rollers where the suction cuts off to release the sheet. You have just seen that the paper levelers and sucker feet are interchangeable. You can move them sidewise to any position necessary to accommodate the stock. There are nine openings in the suction tube, and the unused openings should be sealed off with nylon plugs. You will get better results if you use as many of the sucker feet as possible for each job. Figure 13-18 shows the positions in which the sucker feet and paper levelers are ordinarily set for an 8-1/2" sheet.

Rubber tips are generally placed over the sucker feet to increase their pulling power. Brown rubber tips are available for use with heavy stocks and black rubber (neoprene) tips are used for thin stocks. When running stocks lighter than 16 pound, slide the gromet up on the sucker feet tubes and turn the suction cups up to reduce the amount of pull.

The blower tubes that fluff the top sheets on the paper pile are combined with the pile height regulators (F) shown in figure 13-16. The tips of the pile height regulators extend over the edge of the pile and exert a slight drag on the stock in the same manner as sheet separators on other presses.

You can adjust the amount of suction and blast with the knobs (B) and (C) shown in figure 13-2. A clockwise turn increases the suction or blast and counterclockwise turn decreases it. To set, turn each knob clockwise as far as it will go; then turn the knobs back one-half turn counterclockwise for card stock; one to two half turns counterclockwise for 20- to 65-pound stock; and 2 to 3 half turns counterclockwise for lighter weight stocks.

Forwarding Rollers

You have already seen that a set of rubber forwarding rollers drop against the sheet just as it is released by the sucker feet and force it against the gripper stops in such a manner that the sheet develops a slight buckle. These forwarding rollers raise again to release the sheet just as the impression cylinder grippers close on it.

The rubber forwarding rollers are driven by a lower (knurled metal) forwarding roller. In time, the upper rollers become worn and replacement is required. To remove the upper rolling unit, you simply loosen the Phillip's head screw at each end of the roller shaft. Many pressmen replace the bearings each time they replace the roller unit.

Sheet Detector Fingers

This press has three sheet detector fingers which are attached to a bar just back of the forwarding rollers. When no sheet is feeding through, these fingers drop into grooves in a metal plate and throw the cylinders out of contact with one another and trip off the counter. These fingers will ordinarily need no adjustment.

Caliper

This press is not normally equipped with a two-sheet choke or caliper. However, a device called a "doubles detector" is available as an optional attachment. If the press you are operating is feeding "doubles," you can generally correct it by lowering the height of the paper pile or reducing the blast and suction with the control knobs (B) and (C) shown in figure 13-2.

Buckle Control Knob

As you have already seen, there are no front guides on this press. As the impression cylinder revolves, the cylinder grippers open to receive the sheet and a set of metal plates (stops) rise to position it. The forwarding rollers force the stock against these stops and it is held with a slight buckle until the stops recede and the grippers close on it.

If you do not have sufficient buckle, the sheets may fail to deliver firmly against the paper stops and if there is too much buckle, the stock may be nicked along the front edge. You can regulate the amount of buckle with the knob (D), shown in figure 13-2.

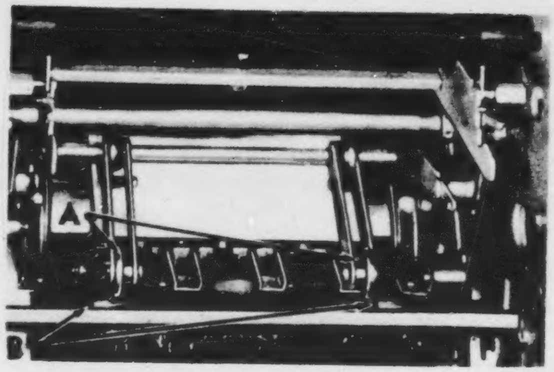
This knob, as you have seen earlier, changes the timing of the feeder by moving the sucker feet slightly forward or backward. Moving the sucker feet forward causes them to deliver the sheet to the forwarding rollers sooner than before and produces more buckle; moving them back delays delivery of the sheet and produces less.

You should set this knob at 0 to 3 on the scale to produce the minimum amount of buckle when you are running heavy stock, and you should set it between 3 and 7 when you are running bond paper. It may be necessary to set it all the way up to 15 to provide maximum buckle when you are running manifold. Since registration may be affected when the setting of knob (D) is changed, you should not change the setting during the run if close register is involved.

DELIVERY UNIT

Following the impression, a cam on the operator's side of the impression cylinder causes the cylinder grippers to open to release the sheet. Ejector fingers then rise to lift the edge of the paper away from the cylinder and force it out over a set of stripper fingers. The stripper fingers strip the sheet from the impression cylinder and direct it under two ejector rollers which force it into the paper receiver.

The ejector rollers (A), shown in figure 13-19, are adjustable sidewise. You should set them along the margins of the sheet so they will not smear the wet ink in the printed areas. The ejector rings (B) are also adjustable sidewise. You should position them inside the ejector rollers if the stock curls up as it is delivered and outside if the stock tends to curl down.



A. Ejector rollers.
B. Ejector rings.

57.326(57B)X
Figure 13-19.—Delivery end of the press.

The receiving tray is equipped with paper guides and a paper retainer which directs the sheets into the tray.

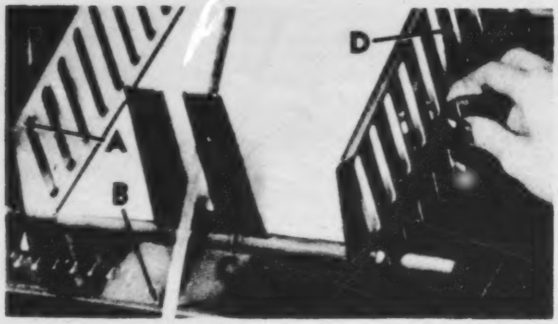
The left paper guide (A), shown in figure 13-20, is stationary and should be set along the scale on the receiving tray to a position that corresponds to the width of the stock. The right guide (D) moves back and forth with a jogging action when the press is in operation. To set it, turn the press until the guide is all the way in. Then place a sheet of stock on the tray against the stationary guide and move guide (D) up to the right edge of the sheet. The end stop (C) should be set for the length of stock being run.

CHAIN DELIVERY

Chain deliveries are available for these presses as optional attachments. They are similar to the chain deliveries already discussed.

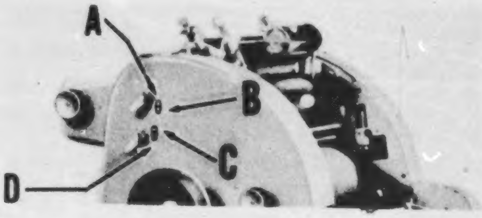
SPEED CONTROL

This press has a speed range of 4,500 to 9,000 impressions per hour. To change the speed, you simply turn the handle (E), shown in figure 13-2, until the desired number appears in the opening to the lower left of the handwheel. (The



A. Stationary paper guide.
B. Paper retainer.
C. End stop.
D. Active paper guide (jogger).

57.327(57B)X
Figure 13-20.—Paper receiving tray.



A. Upper form roller adjusting screw.
B. Lock screw.
C. Lower form roller adjusting screw.
D. Lock screw.

57.328X
Figure 13-21.—Form roller adjusting screws on the near side of the press. Additional adjusting screws are located on the far side.

numbers on the indicator show steps, not the actual speed of the press, of course.) The speed should be changed only when the press is operating.

PRESS ADJUSTMENTS

The following paragraphs describe some of the more common adjustments for the A. B. Dick press.

Roller Adjustments

You can test the form roller-to-plate tension by dropping the inked rollers against a plate. Raise rollers and examine an inked line left on the plate. The lines should be from 1/8 to 3/16 of an inch wide and even from end to end.

(Note.—If your press is equipped with the operation control lever (P), shown in figure 13-2, you must move the lever to the "ink" position in order to get a true stripe when you drop the rollers against the plate.)

Figure 13-21 shows the adjusting screws for the form rollers. There are similar screws on the far side of the press. You can reach them with a screwdriver through the openings in the press frame.

You can increase the pressure on the near end of the upper form roller by loosening the lockscrew (B) and turning the adjusting screw (A) counterclockwise. To increase the tension on the far end of the roller, loosen the lockscrew on the far side of the press and turn the adjusting screw clockwise. Retighten the lockscrews when the adjustment is satisfactory.

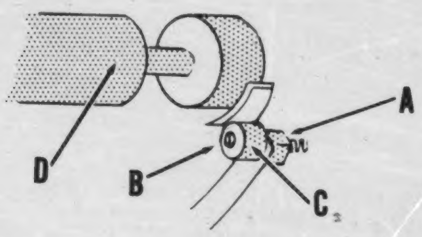
The lower form roller is adjusted in a similar manner.

Aquamatic Ductor Roller

To check the setting of the aquamatic ductor roller, move it against the aquamatic oscillator; then move it back and examine the line left on the oscillator. If the line is not uniform, you can adjust one end of the ductor by loosening the locknut (A), shown in figure 13-22, and turning the eccentric screw (B) to raise or lower truck (C).

Removing End Play

To remove end play from the form rollers, put the night latch on to free the rollers. Then loosen the setscrews and push the bearings at the end of the roller shafts in toward the rollers as far as they will go without binding. Retighten



A. Locknut.
B. Adjusting screw.
C. Truck.
D. Ductor roller.

57.330
Figure 13-22.–Aquamatic ductor roller adjustment.

the setscrews and check to see that the rollers turn freely.

To remove end play from the distributor rollers, loosen the collars on the near end of the roller shafts and push then toward the press frame.

The locations of the roller setscrews are shown in figure 13-23.

Cylinder Adjustments

The plate and impression cylinders adjust automatically for any thickness of stock or plate. Since settings for these cylinders are factory adjusted, the pressman is not required to make any of the usual tension and paralleling adjustments to the cylinders. If major adjustments are required, they are normally made by a press mechanic rather than by the pressman.

Cylinder Gripper Adjustments

Figure 13-24 shows the adjusting screws used in regulating the gripper tension and the distance the grippers open. Both of these screws are located on the near side of the press at the end of the impression cylinder, just inside the press frame.

To adjust the tension on the grippers, turn the handwheel until the grippers open to receive the paper at the end of the feedboard. Then place a sheet of paper (over the forwarding rollers) with the front edge of the stock against the gripper stops. Turn the handwheel until the paper is gripped and just ready to be drawn into the printing unit. Then adjust screw (A) so that a firm pull is required to remove the paper from the grippers. A counterclockwise turn of screw (A) increases the pressure and a clockwise turn decreases it.

The chances are that it will not be necessary for you to disturb the setting of screw (B). However, if the grippers become bent, or if you find that they are not opening the proper distance for some other reason, you should turn the press until the grippers are 1/4 of an inch above the stripper assembly at the delivery end of the press. Then adjust screw (B) until the gripper tips are 11/32 of an inch above the edge of the cylinder when the grippers are open.

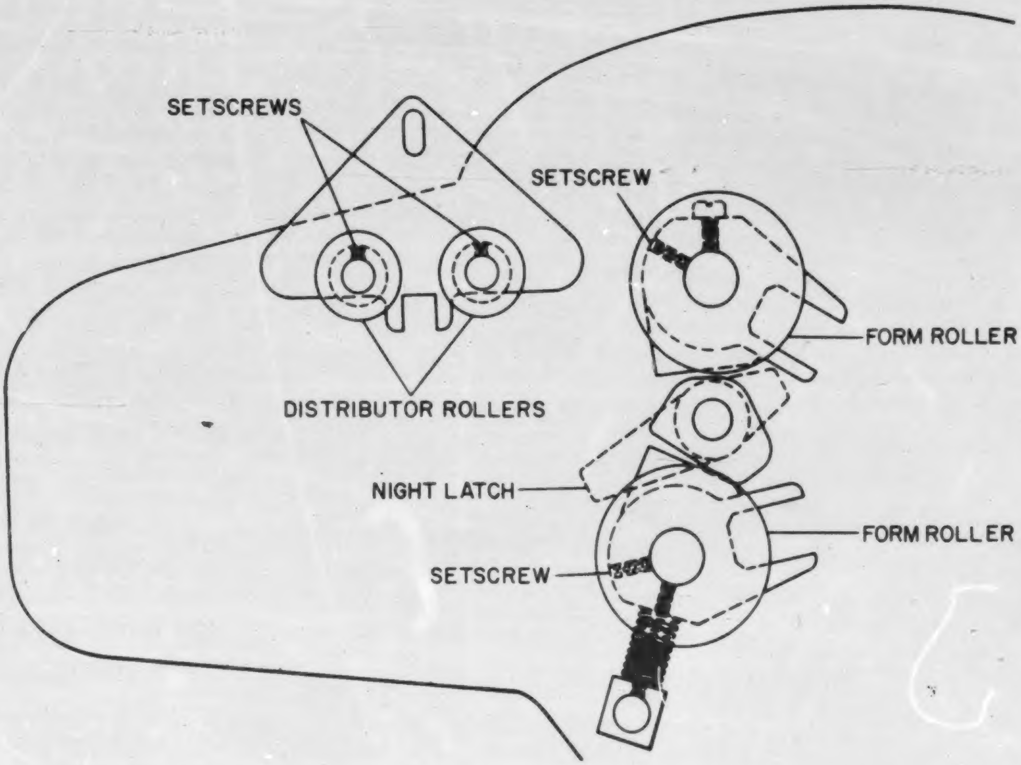
WASH-UP OPERATIONS

At the end of the day, you should remove the water bottle and drain the aquamatic fountain. Remove as much ink as possible from the ink fountain; then remove the fountain and the ink ductor roller and clean them by hand. You should also clean the ink fountain roller manually.

Next, insert a sheet of paper between the rollers and turn the press by hand to run the sheet up between the rollers. Turn the press back to remove the sheet, and then run another sheet into the rollers, continuing this process until you have removed as much excess ink as possible.

Finish cleaning the rollers with a blotter clean-up sheet attached to the plate cylinder. Move the operation control lever (P) shown in figure 13-2 to the "ink" position and set the aquamatic control lever (M) at No. 45. Release the aquamatic lock-out latch (L) by moving it toward the feeder end of the press. Apply blanket wash to the ink oscillating roller and allow it to work thoroughly into the inking system.

Next, move the operation control lever (P) back to its "neutral" position and move the aquamatic control lever (M) to its "off" position. Stop the press and put on another blotter



57.331X

Figure 13-23.—Lateral adjustments for form rollers and distributor rollers.

clean-up sheet. Repeat this procedure until the rollers are completely clean and dry.

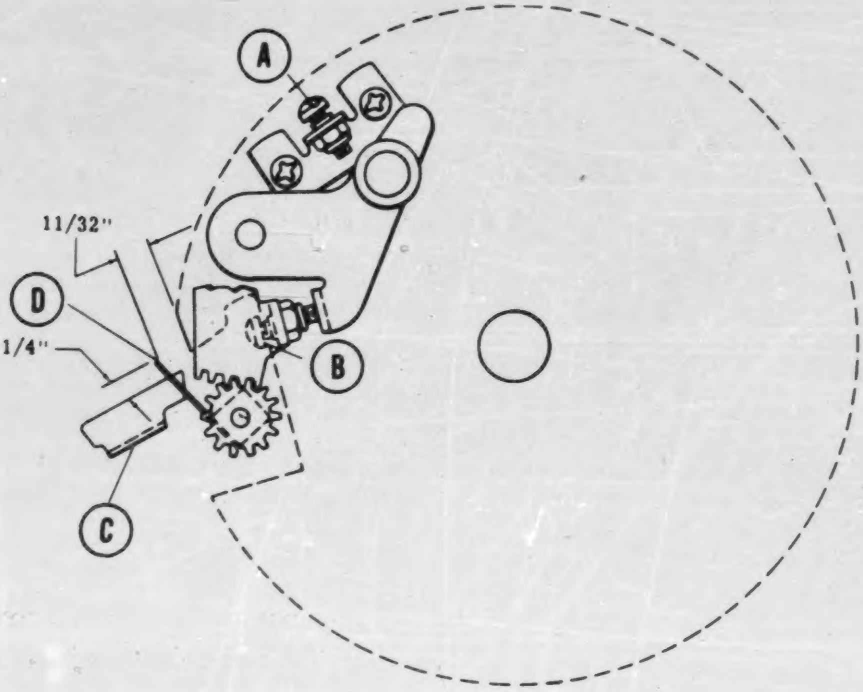
Finally wipe the aquamatic unit rollers and fountain clean and dry. Loosen the knurled knob on each side and remove the aquamatic tray and clean it of paper lint, if necessary. (See figure 13-25.) Then replace the tray, the ink ductor roller and the ink fountain.

The procedure is similar for cleaning older models of the press, except that the ink ductor roller is not removed from the press and it is necessary to drop the ink form rollers with the handles (I) shown in figure 13-2 when you are using the blotter clean-up sheet. Set the aquamatic control lever at No. 45 on the scale and distribute the cleaning solution evenly over the rollers. Do not apply the cleaning solution so freely that it will accumulate in the aquamatic fountain.

Finally go over the rollers with a rag moistened with solvent. Wipe all rollers and the aquamatic fountain clean and dry. On some of the older presses, you can remove the aquamatic unit for cleaning. Loosen the two knurled knobs, set the aquamatic control lever to No. 45 and throw on the aquamatic night latch. Then lift the unit away from the inking rollers.

SECURING THE PRESS

At the end of the day, and during long shutdown periods, you should break the contact



A. Screw used in adjusting tension on grippers.
B. Screw which regulates distance grippers open.
C. Stripper assembly.
D. Gripper.

57.332X

Figure 13-24.—Impression cylinder gripper adjustments.

between the rollers to relieve the tension and prevent them from becoming flat.

Raise the form rollers with the handles (I), shown in figure 13-2; then lift the ink oscillating roller until it is out of contact with the other rollers and tilt it toward the ink fountain. You will find that it will stay in this position until you lower it again by hand.

Next, remove the aquamatic oscillating roller and place it in the support bracket (G) shown in figure 13-4. Remove the fountain solution bottle and place it on a table. Then set the aquamatic night latch lever (N) and the operation control lever (P) shown in figure 13-2, to the "night latch" positions. You can follow the same procedure when you are securing the older models of the press. The night latch lever for the ink rollers is found on the far side of the press on the older models.

STEP-BY-STEP OPERATIONS

1. At the beginning of the day or at regular intervals, clean and lubricate the press.

2. At the beginning of the day, move the aquamatic and ink rollers from their night latch positions.

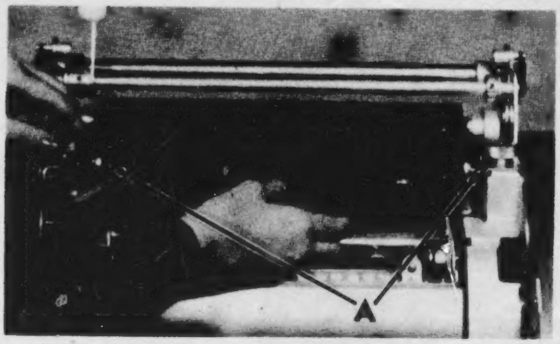
3. Place the aquamatic oscillating roller and the ink oscillating roller in position.

4. Put ink in fountain. Adjust keys to distribute even film of ink over fountain roller.

5. Move ink fountain control lever to fourth position; set aquamatic control lever at No. 45 and raise the aquamatic lockout latch.

6. Run press to distribute ink evenly over all rollers including the aquamatic rollers.

7. Mix fountain solution and fill bottle. Insert bottle into holder in fountain. (Note.—Never add fountain solution until after the rollers are thoroughly inked.)



A. Knurled knobs. Loosen when removing pan.

57.336(57B)X

Figure 13-25.—Removing the fountain pan from the press.

8. Move aquamatic control lever to its "off" position; lower the aquamatic lockout latch; and turn off the press.

9. Set feeder. Move piling guides to point along scale at front of feed table that corresponds to width of stock being run.

10. Set paper stack supports so that back stop will clear both supports when table rises as last sheets are fed into press.

11. Lower feed table and load stock.

12. Raise feed table until top sheet in pile contacts pile height regulators when regulators are in their lowest position.

13. Set the back stop and two side guides against the back and sides of the stack. The spring guide should be placed on left side if you are registering to the right and vice versa. Reverse spring when changing guide from one side to another.

14. Adjust paper weight, if necessary, for type of stock being run.

15. Position sucker feet, if necessary. Attach rubber tips to feet according to type of stock being run. Adjust caliper, if necessary (if press is equipped with caliper).

16. Set paper guides in delivery unit.

17. Mount plate on cylinder. Sponge plate and start press in operation. Move aquamatic control lever to No. 20 or 25 and ink control lever to No. 1 or 2.

18. Drop the upper and lower form rollers against the plate with handles (I) shown in figure 13-2. Move the operation control lever to the ink position. Watch plate as press revolves. If it tends to pick up ink, increase water feed and reduce ink supply.

19. Push the operation control lever to the "image" position and hold it there for two to four revolutions to allow the image to build up on the blanket.

20. Turn on vacuum pump and move the operation control lever to its extreme right (feed) position to start sheets feeding.

21. After the first sheet feeds through, lower the paper feed lever to stop the sheets feeding. Check for position of image on sheet.

- a. If image is not centered sidewise, move paper stack or release plate from tail clamp and make small lateral adjustment (up to 1/4") by turning knob to move head clamp sidewise.
- b. If image is not straight on paper, release plate from tail clamp and turn the angular adjusting knob to twist head clamp on plate cylinder.
- c. If image is too high or too low, rotate impression cylinder to change position of grippers in relation to image on blanket.

21. Adjust buckle control knob, if necessary, to provide proper buckle in stock.

22. Start press and pull another impression. Check for proper position, ink distribution, and low spots that are not printing properly. Change blanket or underlay low areas with strips of paper if necessary.

23. Set counter at 00000; sponge plate and begin run.

24. Examine work at regular intervals; watch ink distribution. Adjust ink and water as necessary.

25. Reload feeder as stock is depleted; remove stock from delivery unit after every 500 impressions. Stack printed sheets in small piles on table.

26. After run is completed, stop press, transfer plate to table. Go over it with gum arabic or other preservative solution if plate is to be saved.

27. Wash blanket and prepare press for next job.

28. At end of day, remove all ink from fountain. Drain fountain solution from aquamatic fountain. Wash ink fountain and clean all rollers. Use blotter cleanup sheets followed by cleaning with cloth moistened with blanket wash. Remove aquamatic unit or pan, if necessary to clean out lint and dirt.

29. Lift the ink and aquamatic oscillating rollers out of contact with the other rollers and throw on ink and aquamatic night latches to relieve tension on rollers.

PRESS MAINTENANCE

If the equipment in your shop includes an A. B. Dick press, detailed lubrication and maintenance procedures are included in the shop's Planned Maintenance Subsystem (PMS). In general, you should oil anywhere that one moving part contacts another. As you lubricate the press, wipe up any excess oil or grease with a rag because paper dust (lint) and dirt tend to accumulate heavily in such areas. Turn the press with the handwheel to reach hard-to-get-to places. Never oil a press while it is running.

In addition to proper lubrication, an equally important part of any maintenance program is equipment cleanliness. Ensuring that the press you are operating is kept clean goes a long way towards producing quality printing. Press cleanliness includes such things as proper roller care to prevent glazing, frequent wiping of the cylinders with a rag to prevent ink build-ups that may cause uneven printing pressures, and attention to feeder and delivery components that may transfer ink or dirt markings to the press sheets.

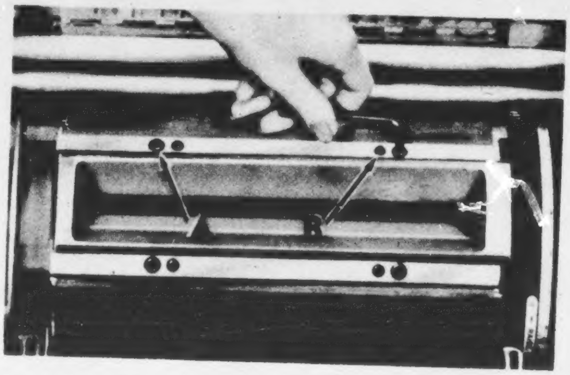
Whenever you are maintaining a press, it's important that you know the equipment. If you are in doubt as to the cause of a particular press trouble, get advice before you become "wrench happy." In many cases costly repair jobs to equipment can be avoided by having qualified personnel make adjustments and repairs. It's too late to ask for help once the damage has been done.

A. B. DICK OFFSET PRESS, MODEL 360

The A. B. Dick Offset Press, model 360 is similar to the model 350 just discussed. Both presses occupy the same amount of floor spaces; however, the 360 will take a sheet as large as 11" X 17" and has a maximum image size of 10 1/2" X 16 1/2".

The method of mounting the blanket on the model 360 varies slightly from that described for the model 350. To remove the blanket, loosen the four set screws shown in figure 13-26 and loosen and remove the four socket head cap screws. Reverse this process to replace it. Blanket bars, like those described in chapter 11 must be attached to the leading and trailing ends of the blanket before it can be mounted on the cylinder.

The plate cylinder varies slightly from that of the model 350; however, the method of mounting the plate is essentially the same.



A. Cap screws.
B. Setscrews.

57.641X
Figure 13-26.—Mounting a blanket on the A. B. Dick Model 360.

CHAPTER 14

THE ATF 20 AND 20A PRESSES

INTRODUCTION

The ATF Chief 20 press, shown in figure 14-1, will take a sheet as small as 8″ X 10″ and as large as 14″ X 20″. It has a maximum printing area of 13 1/2″ X 19 1/2″. This press is sometimes referred to as the "Webendorfer" or the "Little Chief" because these names were used in connection with older models.

SPEED CONTROL

This press has a speed range of from 3200 to 5500 impressions per hour. You can change the speed while the press is in operation by turning the Adjustomatic Drive Knob on the far side of the press. (See fig. 14-2.) A clockwise turn of the knob increases the speed and vice versa.

On the older models of the press there are two grooves in the pulley on the press motor. When the drive belt is riding in the smaller groove, the press operates at a speed of 3600 impressions an hour; and when the belt is shifted to the larger one, it operates at 5000 impressions an hour. To change from one speed to another, you must stop the press and then shift the motor to bring the desired groove into alignment with the drive wheel and belt. The long handle attached to the motor rests in the two-notched bracket (B) shown in figure 14-3. To change the position of the motor, you simply shift the handle from one notch in the bracket to the other.

Once the motor has been shifted to the correct position, you can transfer the drive belt to the proper groove on the pulley by hand.

STARTING AND STOPPING THE PRESS

There are two sets of starting and stopping buttons. One is located at the delivery end of the press and one is located on the near side at the feeder end. (See fig. 14-1.) The control panel at the feeder end is also equipped with a switch for the vacuum pump motor.

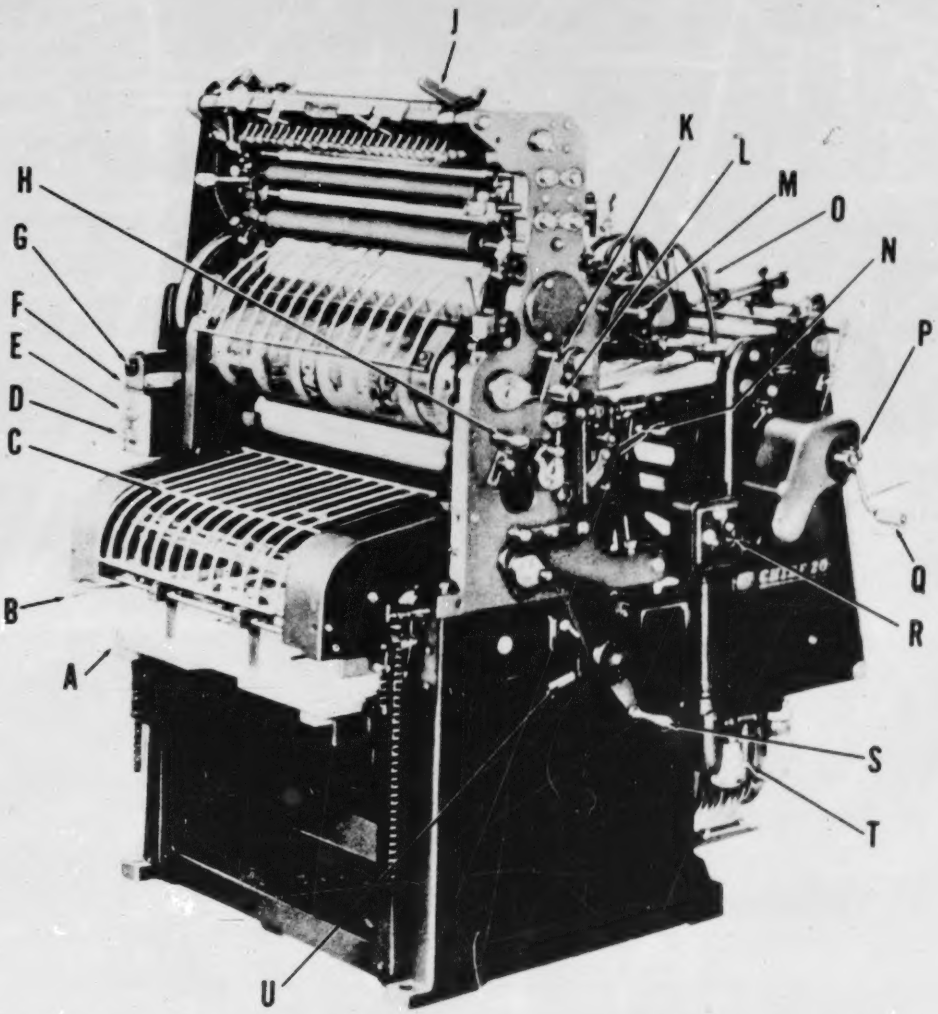
You will find a latch on the control panel at the delivery end of the press. (See fig. 14-4.) When this latch (A) is pushed over the stop button, the press will run as long as you hold your finger on the start button, but will stop as soon as you release it. Pressmen use this device to inch the press (move it a short distance at a time) when they are mounting the blanket or plate or doing other makeready operations. Always push the latch down so that the press will operate continuously when you are ready to begin the run.

The control panel at the feeder end of the press does not have a "safety latch" or "incher." However, you can inch the press from that station, provided the latch is pushed up on the delivery-end control panel. Some models are equipped with an inching button on each control panel, and the operator uses it instead of the latch when he is jogging the press.

FEEDER CONTROL LEVER

It is a good idea to move the press by hand or to inch it around for one full revolution before turning it on at full speed. This may prevent damage to the cylinders in case anything is out of place.

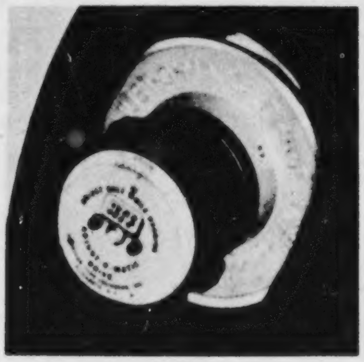
You can then push the button to start the press and trip the toggle switch to start the vacuum pump operating. Of course, the sheets will not begin feeding through until you close the air suction inlet, a hole on the near side of the press. The sucker feet have no lifting power as long as this hole is open. To close it, you simply push down on the feeder control lever (N), shown in figure 14-1.



A. Delivery platform.
B. Adjustment rod used in setting delivery joggers.
C. Guard.
D. Front end control panel for starting and stopping the press.
E. Inching latch.
F. Counter.
G. Knob for setting counter.
H. Lever used in adjusting pressure between the blanket and impression cylinders.
J. Lever used in turning ink fountain roller by hand.
K. Lever used in raising ink form rollers.
L. Knob used in raising ink form rollers.
M. Lever used in moving dampening form rollers to or away from plate.
N. Impression or feeder control lever.
O. Pile height governor.
P. Ratchet pawl release.
Q. Crank for lowering feed table.
R. Control panel for starting and stopping press.
S. Crank for raising and lowering delivery platform.
T. Blast adjustment.
U. Lever for adjusting rate of descent of delivery platform.

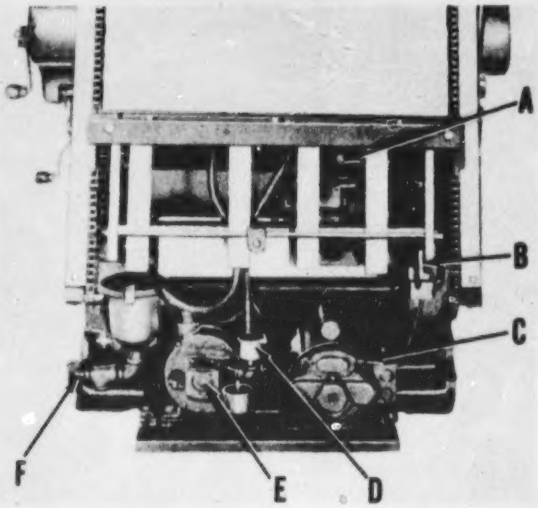
57.366X

Figure 14-1.—Operating controls on the Chief 20.



57.367X

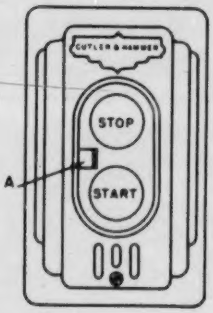
Figure 14-2.—Speed control adjustment found on later models. Located on far side of press. Dial is marked in hundreds to show number of impressions per hour.



A. Press motor.
B. Bracket for press motor handle.
C. Pump motor.
D. Oil reservoir.
E. Vacuum pump.
F. Blast adjustment.

57.368X

Figure 14-3.—Vacuum pump and motor (located under feed table).



57.369X

Figure 14-4.—Control panel at the delivery end of the press. Push latch (A) over the stop button when inching the machine.

The feeder control lever serves two purposes. It closes the air suction hold and also throws on the impression. You can start the sheets feeding through and throw on the impression simultaneously by pushing this lever all the way down until the impression throw-off lever (B), shown in figure 14-5, drops against it and locks. The impression will stay on automatically thereafter unless it is thrown off by the sheet detector finger. You can throw off the impression by hand, by raising lever (B) or by pushing in the emergency throw-off lever (J), shown in figure 14-9.

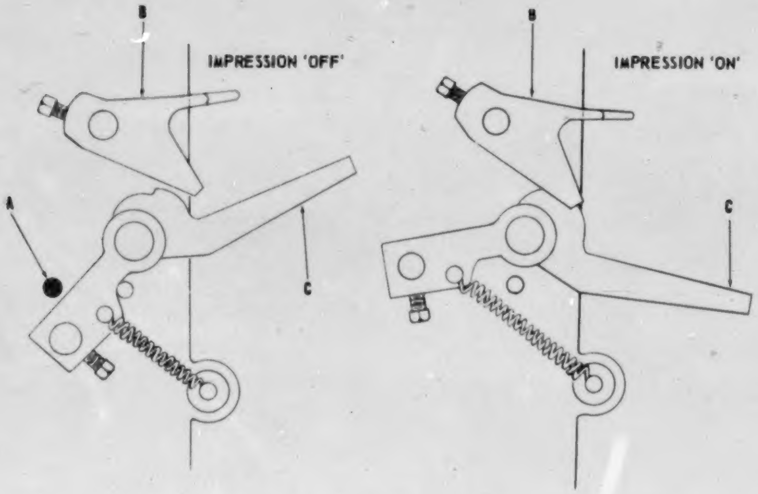
To print a single sheet during makeready operations, pressmen generally shut off the air just as the first sheet reaches the forwarding rollers. The sheet detector then trips off the impression and ink automatically after the sheet feeds through the press.

FEEDER UNIT

The feeder on this press is similar in operation to those discussed in preceding chapters of this book. However, it has certain features not found on other presses.

Loading the Stock

You can lower the feed table by lifting release ratchet (B), shown in figure 14-6, and turning



A. **Air suction inlet.**
B. **Impression throw-off lever.**
C. **Feeder control lever.**

57.370X

Figure 14-5.—The feeder control lever.

the crank (A) counterclockwise. Always have a firm grip on the crank before you lift release ratchet (B), because this lever releases the gear and the feed table will drop if you do not hold the crank securely.

After you have lowered the feed table, you should crease one of the sheets to be run to find its center. Then place it on the feed table about 1/4 of an inch off center toward the side guide to be used. (As you will see later, this press is equipped with a side guide on both the right and left sides of the feedboard. Either may be used in registering the sheet.)

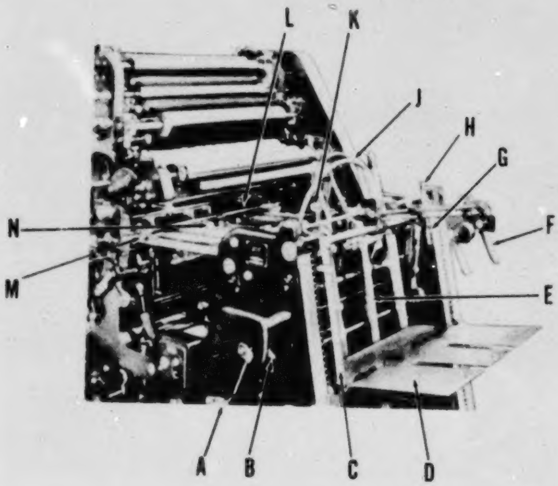
The feed table may be marked to show its center, but if it is not, you must approximate the position for the sheet. You can then bring the side piling bars (C), shown in figure 14-6, up to the sides of the sheet and lock them in place, leaving a slight clearance between the bars and the stock.

Next, jog the stock and load it onto the table. If the paper curls, you can even the stack by slipping wooden wedges under the low corners. Always place the wedges under the pile; never insert them in the center of the stack, as this might allow them to feed into the press.

Once the stack is loaded, you can raise the feed table by turning crank (A). Stop when the top sheet is 1/4 inch below the sucker feet when they are in their lowest position. It may be necessary to turn the press to move the sucker feet into their lowest position.

Tail Guides

Next, set the tail guides (F), shown in figure 14-6, to rest lightly against the back edge of the pile. The tail guides can be moved in or out along the rod to which they are attached to accommodate various lengths of stock. (See fig. 14-7.) They can also be moved sidewise, but they must always be set directly above the slots on the feed table so that they will enter these slots as the last sheets of the stack are fed into the press. If the guides are not positioned correctly, the feed table may work up against them and jam.



A. Crank for lowering feed table.
B. Ratchet release for crank (A).
C. Side piling bar.
D. Feed table.
E. Front piling bar.
F. Tail guides.
G. Pile height governor.
H. Adjusting screw for pile height governor.
J. Suction tubes.
K. Caliper.
L. Sheet detector finger.
M. Hook for side guide spring.
N. Gripper edge sheet guards.

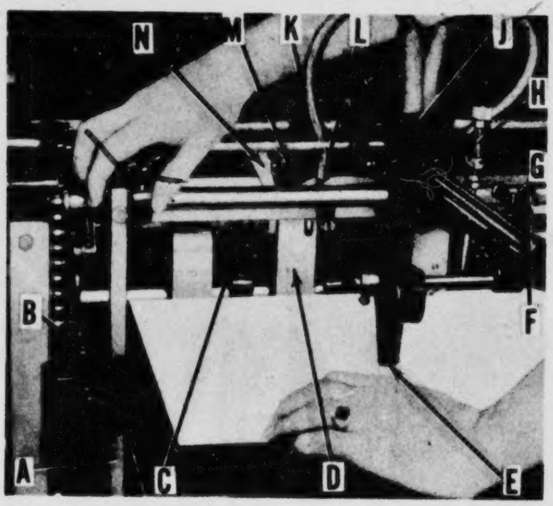
57.371X

Figure 14-6.—Feed table controls.

You can regulate the pressure on the stock by adjusting the angle of the guides. The angle shown in figure 14-8 is correct for ordinary stocks, but pressmen sometimes set them to rest against the stack with less angle when they are running thin paper. You can swing the guides back to the position indicated by the dotted lines in figure 14-8 when you are loading the feeder.

Pile Height Governor

You have already seen that the normal working position for the paper stack is 1/4 of an inch below the front suckers when they are in their lowest position.



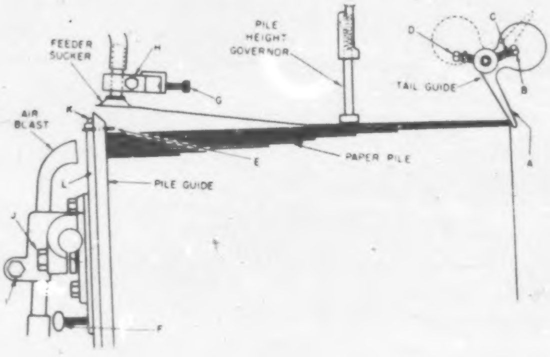
A. Side piling bar.
B. Feed table.
C. Blower.
D. Front piling bars.
E. Tail guide.
F. Thumbscrew for positioning tail guides.
G. Pile height governor.
H. Adjusting screw for pile height governor.
J. Thumbscrew for positioning pile height governor.
K. Suction tubes.
L. Sucker feet (partially hidden)
M. Forwarding roller.
N. Conveyor tape.

57.372X

Figure 14-7.—Feeder controls.

Once you have raised the stack to this height, you should set the pile height governor (G) shown in figure 14-7. Move the press to bring the governor to its lowest position; then turn the knurled adjusting screw (H) until the tip of the governor touches the top of the stack.

You can make the stack run higher or lower during the run, if necessary, by adjusting screw (H). A clockwise turn will lower the stack and vice versa.



A. Tip of tail guide.
B. Setscrew. Serves as stop for pin (C).
C. Pin.
D. Setscrew. Serves as stop when guide is turned back.
E. Separator finger.
F. Thumbscrew. Loosen when raising or lowering separator finger bar (L).
G. Setscrew. Loosen when positioning sucker foot sidewise.
H. Bolt which holds sucker foot in holder.
I. Bolt. Loosen when raising or lowering blower tube.
J. Bolt. Loosen when positioning blower tube sidewise.
K. Setscrew. Loosen when moving separator finger in or out.
L. Metal bar.

57.236BX

Figure 14-8.—Diagram of feeder parts. Although they serve the same purpose, the parts on the left side of the diagram vary slightly on the Chief 20A.

The pile height governor can be moved in or out along the rod to which it is attached. You should set it about 1 1/2 inches in from the back edge of the stock. The thumbscrew (J), shown in figure 14-7, holds it in place.

Sucker Feet

Some models of this press have three sucker feet and others have four. (See figs. 14-7 and 14-8.) These feet are attached to a cam-operated rod which swings back and forth when the press is running, alternately carrying the feet down to the top of the stack and up again to the edge of the feedboard. As the feet dip down, the suction goes on, and they pick up the sheet and carry it to the edge of the feedboard. At this point, the suction automatically cuts off and the sheet is released to the forwarding rollers (M), shown in figure 14-7, which force it onto the conveyor tapes.

You can loosen the setscrew (G), shown in figure 14-8, and move the sucker feet sidewise as necessary to accommodate different widths of stock. After moving the feet, always check to see that they do not contact the forwarding rollers before starting the press.

Most presses are equipped with two types of sucker feet. On some presses, the feet used for thin stocks have 3 suction holes and those used for heavier paper have only 1. In addition, pressmen generally slip rubber (bell-shaped) tips over the regular sucker feet when they are running cardboards or stock that is difficult to pick up. Some pressmen use a rubber tip over the center suckers at all times.

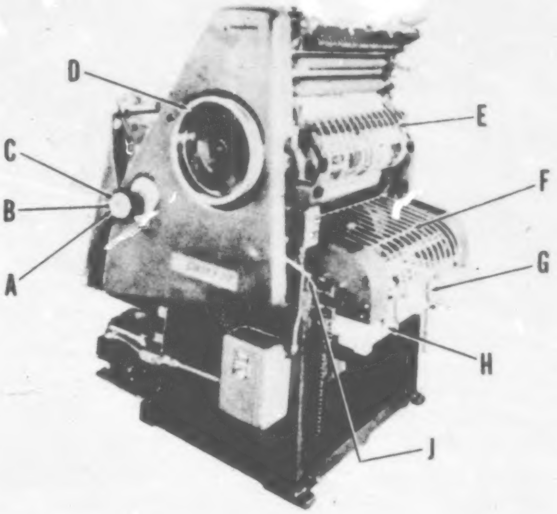
You can change from one set of feet to another in a matter of minutes. You simply loosen the bolts (H), shown in figure 14-8, and disconnect the air hoses to remove the feet, and reverse the process to mount the new ones.

Always push each foot up as far as it will go into the holder to guard against setting one lower than the others. The wide end of the V-shaped groove on the bottom on each metal foot should be set facing the cylinders.

You can regulate the suction for different weights of stock by moving the lever which opens or closes a hole in the suction box (B), shown in figure 14-9.

Blower Tubes

The blower tubes (C) are shown in figure 14-7. They can be moved sidewise or raised or lowered, as necessary. You can regulate the amount of blast by turning the thumbscrew (F), shown in figure 14-3. The blast for the center blower can be regulated further with a T-screw adjustment found on the box where the blast tubes branch out under the feeder. The adjustment for the center blower is located outside the press frame on the newer models. (See fig. 14-1.)



A. Speed control knob.
B. Suction box (hidden).
C. Suction adjustment lever (hidden).
D. Flywheel for turning press by hand.
E. Wire guard. Remove when mounting plate or blanket.
F. Wire guard. Swing up when setting joggers.
G. Front stops.
H. L-shaped handle used in setting side jogger.
J. Emergency throw off lever (for impression).

57.373X
Figure 14-9.—Adjustments on far side of press.

Separator Fingers

This press is equipped with two separator fingers, each consisting of a short strip of steel protruding from the top of a long metal bar. The long bars are attached to the back of the front piling bars (D), shown in figure 14-7, and the steel tongue projects through a slot in the piling bars.

You can loosen the setscrews (K), shown in figure 14-8, and move the steel tongues (E) in or out over the front edge of the stack. They should be set in as far as possible, without interfering with the action of the sucker feet. To raise or lower them, you simply loosen the thumbscrew (F), shown in figure 14-8, and move the bars (L) up or down. The tongues are ordinarily set slightly below the suckers when the suckers are in their lowest position.

Forwarding Rollers

The forwarding rollers are set directly over the conveyor tapes as shown in figure 14-7. They need little attention unless the sheets feed crooked. You can adjust the tension on each roller individually with the adjusting screw (A) shown in figure 14-11.

Caliper

The caliper is attached to the same bar as the forwarding rollers and is normally centered between them. To set it, you must loosen the locknut (D), shown in figure 14-10, and turn the knurled screw (C). It is set correctly when a single sheet passes freely under choke (B), while two sheets bind.

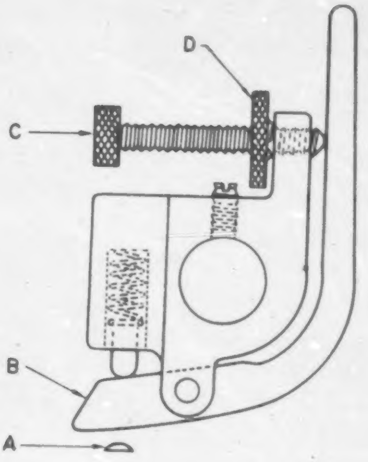
In setting the caliper, some pressmen fold a slip of paper so that they have a double thickness at one end and a single thickness at the other. They work this paper back and forth between the choke (B) and rivet head (A) while they adjust screw (C). When they reach the point that the folded end of the strip binds, while the single thickness still slides freely between the two points, they retighten locknut (D).

Conveyor Tapes

The Chief 20 has two conveyor tapes. (See fig. 14-7.) These tapes are kept taut by idler pulleys below the feedboard. They cannot be moved sidewise, their position is fixed. They ordinarily need little attention; but as you will see later in this chapter, they must be changed when they become damaged or worn.

Sheet Controls

The sheet guards shown in figure 14-6 hold down the sheet as it is carried to the end of the feedboard. These strips of spring steel are similar



A. **Rivet head.**
B. **Choke.**
C. **Adjusting screw.**
D. **Locknut.**

57.374X

Figure 14-10.–Diagram of the caliper.

to the sheet guards found on the Multilith. They can be moved sidewise if necessary, to accommodate different sizes of stock.

The sheet is further controlled by two driver wheels (speed wheels) like the one shown in figure 14-11. These wheels are generally attached to the two metal sheet guide rods extending from the forwarding roller brackets. (See fig. 14-11.) They should be positioned just off the tail edge of the sheet when it is resting against the front guides.

An extra set of driver wheels may be used if the sheet is less than 10 inches long. The extra wheels should be positioned between the regular set and the forwarding rollers. You can adjust the tension on the driver wheels with the collar (B) shown in figure 14-11.

The rider balls (guide balls) are generally set near the end of the conveyor tapes. (See fig. 14-11.) Steel balls are used for heavy stock and glass balls are used for medium weights. Small sheets do not require riders.

In addition to the controls just discussed, these presses are also equipped with four gripper edge sheet guards that guide or channel the sheet in to the cylinder grippers. These guards are attached to the front guide shaft and can be moved sidewise to accommodate different widths of stock. The outer guards are generally set near the outside edges of the sheet and the inner guards are spaced between the two front guides. (See fig. 14-6.)

Sheet Detector Finger

The function of the sheet detector finger (L), shown in figure 14-6 has been discussed in preceding chapters of this book. When a sheet fails to feed through the press, this lever drops into a slot and actuates a mechanism that throws off the impression and ink. The finger should ride just slightly in front of this slot when the impression is on. You can loosen the allen screw and move the arm forward or backward, if necessary.

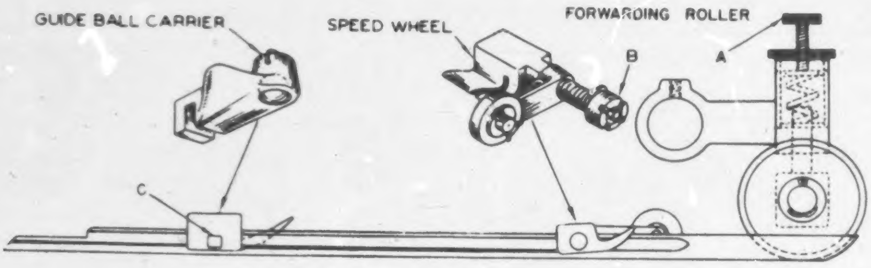
Front Guides

This press is equipped with two front guides like the one shown in the diagram in figure 14-12. Although they serve the same purpose as the front guides on the smaller presses, the construction and operation of these guides are slightly different. Instead of receding, they rise at the proper moment to release the sheet to the cylinder grippers.

This action is controlled by a cam at the far end of the impression cylinder. As the cam roller passes over this cam, it operates a lever which turns the bar to which the guides are attached. When the roller enters the low part of the cam, the bar turns to move the guides down, and when it travels on to the high part of the cam, the guides are forced up. You can change the timing of the guides by adjusting this cam. The cam should be set so that the guides will start to rise (move forward) a second after the cylinder grippers close on the edge of the sheet.

Undertongues

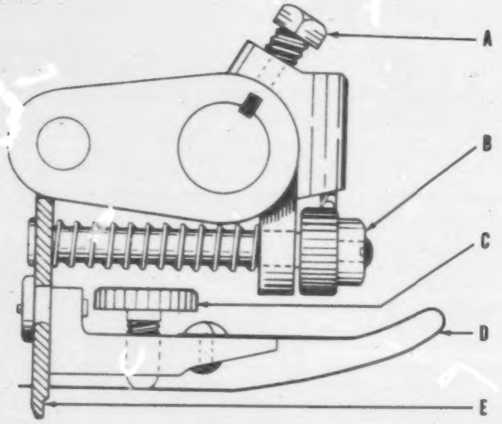
The front guides should be centered over the metal tongues which extend from the underside of the feedboard. (See fig. 14-13.) You should position them over the outside tongues for large



A. Screw for regulating tension on forwarding roller.
B. Collar for regulating tension on speed (driver) wheels.
C. Setscrew.

57.375X

Figure 14-11.—Sheet controls.



A. Square-headed screw. Loosen when moving guide sidewise.
B. Screw used in changing gripper margin. Clockwise turn provides less gripper bite; raises image on paper.
C. Screw which regulates clearance for paper stock.
D. Spring guard which guides sheet in to plate (E).
E. Plate which serves as stop for sheet.

57.376X

Figure 14-12.—Diagram of the front guide.

sheets and over the inside tongues for small stock. The tongues are factory set and will seldom need adjusting. If it is necessary to reposition them, you should set them against the feedboard with a slight pressure. Then check to see that they clear the impression cylinder grippers properly before starting the press.

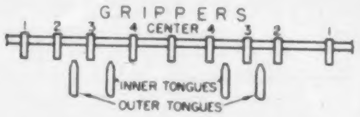
Front Guide Adjustments

To move the front guides, you must turn the press until they rise. Then loosen the square headed screws (A), shown in figure 14-12, and move each guide to the proper position. Turn the press to drop the guides and center them over the tongues before retightening screws (A).

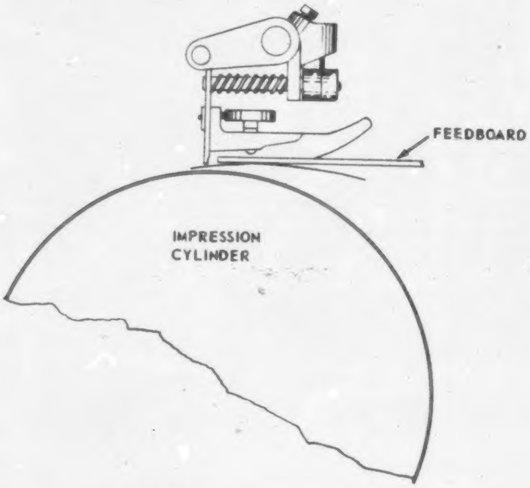
Gripper Margin

You can regulate the gripper bite (margin) by turning the screw (B) shown in figure 14-12. A clockwise turn moves plate (E) toward the feeder end of the press, giving the grippers less bite on the sheet and raising the printing on the paper.

If the image prints slightly crooked on the paper, you may be able to straighten it by adjusting the guides. When one guide is set for less gripper bite than the other, the paper tends to feed crooked, and thus compensates for the crooked image on the plate.



The undertongues should be centered between the impression cylinder grippers, as shown.



Tongues come against bottom of feedboard with a slight bend. To regulate bend and clearance to cylinder, loosen screw below feedboard.

57.377X
Figure 14-13.–Adjustments for the undertongues.

However, setting the guides for an uneven gripper bite may cause register troubles, so if the image is very crooked, it is better to twist the plate on the cylinder or to have the plate remade.

You can also raise or lower the image on the paper by adjusting these guides. As you have just seen, a clockwise turn raises the image and a counterclockwise turn lowers it. The maximum gripper margin is 5/16 of an inch and the minimum is 3/16 of an inch.

The spring guard (D), shown in figure 14-12, directs the sheet in to the plate (E). You can lower or raise it to accommodate different thicknesses of stock by turning screw (C). There should always be a slight clearance between the spring and the stock.

Side Guides

You have already seen that this press is equipped with two side guides, like the one shown in figure 14-14. These guides are attached to a bar at the end of the feedboard which moves back and forth (sidewise) as the press operates.

As a rule, pressmen use the guide on the near side of the feedboard for the ordinary run of work, but they use the guide on the far side when they are backing up a job or for other reasons. It is not necessary to remove the unused guide from the press. You can simply position it near the edge of the feedboard where it will not contact the sheet nor interfere with any of the other parts of the machine.

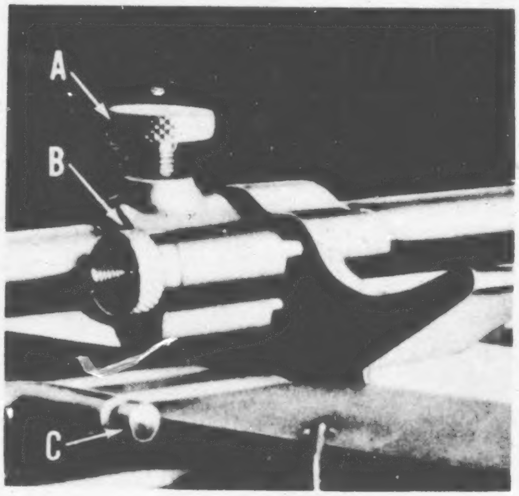
When you change from one side guide to the other, you must shift the spring shown in figure 14-15. One end of the spring is always hooked over pin (B). The other end should be hooked over pin (C) when you are using the near side guide and over pin (A) when you are using the far guide.

When you change the spring from one pin to the other, you must also shift the hole in link (F) from pin (D) to pin (E) or vice versa. Slip the link over the lower pin (E), as shown in the illustration, when you are using the near side guide and over the top pin (D) when you are using the far guide.

Setting the Side Guide

It will not be necessary to shift from one side guide to another each time you change jobs, but it will be necessary for you to set the guide in use to the size of the new sheet being run.

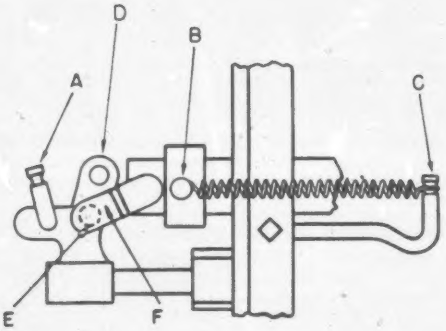
First move both guides to the edges of the feedboard. Then turn on the vacuum pump and inch the press to deliver a sheet down the feedboard. Stop when the sheet reaches the front guides and the side guide to be used is at the end of its inward thrust. Move the paper sidewise 1/4 of an inch (away from the side guide). Then loosen the screw (A), shown in figure 14-14, and move the side guide to the edge of the sheet. Tighten screw (A) to lock it in place.



A. Setscrew. Loosen to move side guide.
B. Micrometer adjusting screw.
C. Hook for side guide spring.

57.378X

Figure 14-14.—The side guide.



57.379X

Figure 14-15.—Diagram of side guide changeover mechanism (located on near side of press at end of side guide shaft). Illustration shows correct setup when guide on near side of feedboard is in use. To switch to far side guide, change spring from pin (C) to pin (A) and switch hole in link (F) from lower pin (E) to upper pin (D).

This setting will cause the guide to push each sheet approximately 1/4 of an inch sidewise and thus ensure proper registration. This first setting is only a preliminary setting, of course. After you print a trial sheet and examine the position of the image on the paper, it may be necessary to make further adjustments to center the image.

You can make minute adjustments with the micrometer screw (B), shown in figure 14-14. If large adjustments are required, it may be necessary to move the side guide itself—or in some cases, to move the stack and change the feeder setup—in order to center the image.

PRINTING UNIT

The printing unit of the Chief 20 is similar in most respects to that of other offset presses.

Mounting the Blanket

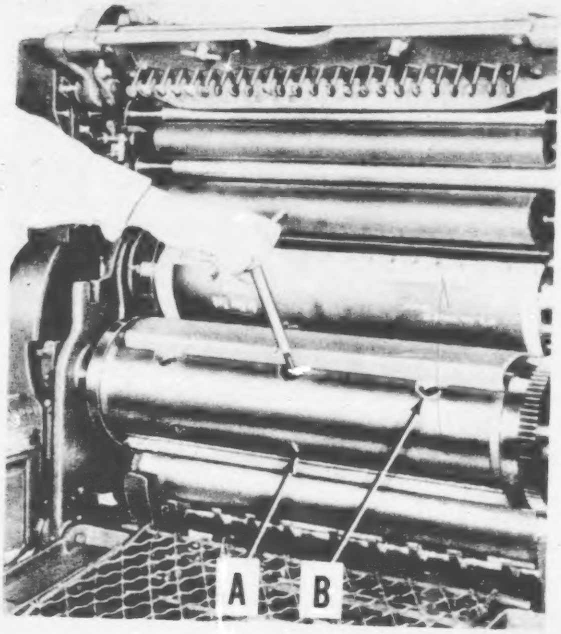
The blanket is approximately 20″ × 16″ in size. You should attach the blanket bars to the long edges, and the short dimension should be wrapped around the cylinder.

After you make sure that the new blanket is squared, you should punch it and attach the blanket bars with the thicker halves of the bars underneath the blanket and the thinner strips on top. Then wash it with blanket wash, dry it, and powder it with a half-and-half mixture of flowers of sulfur and talcum powder. The blanket is then ready for mounting on the press.

Remove the wire guide (E), shown in figure 14-9, and turn the press until the cylinder gap faces you. Then insert the blanket bar for the leading edge of the blanket into the recess at the lower edge of the cylinder and secure it with the single allen setscrew (A), shown in figure 14-16.

Next, measure the thickness of the blanket at several points with a micrometer to determine the amount of underpacking required. Add enough packing to bring the total thickness to 0.002 of an inch above the height of the cylinder bearers.

The total thickness will amount to 0.073 of an inch, since the blanket cylinder on this press is undercut 0.071 of an inch. The blanket may vary in thickness from 0.063 to 0.066 of an

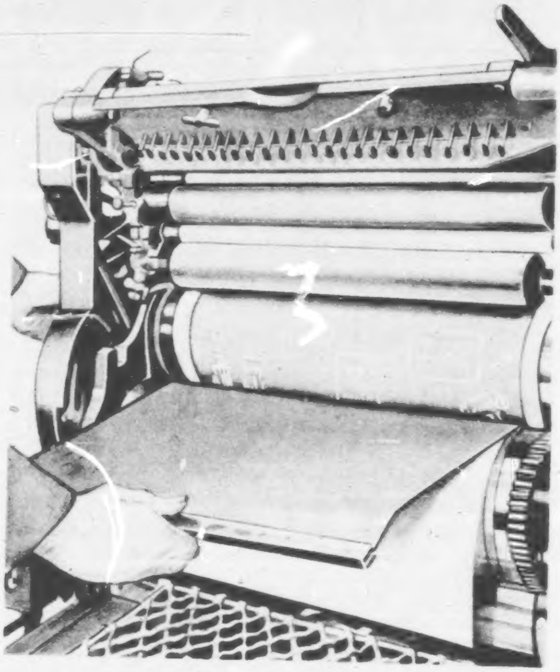


57.380X

A. Setscrew. Tighten against leading edge blanket clamp bar.

B. Lugs for trailing edge blanket bar.

Figure 14-16.—Mounting the blanket on the cylinder.



57.381X

Figure 14-17.—Turn the press with the handwheel on the far side or inch it to draw the blanket and packing around the cylinder.

inch, so the underpacking must be varied accordingly.

Slip the required number of packing sheets (cut slightly smaller than the blanket) behind the blanket and turn the press by hand or inch it with the impression off to wrap the blanket around the cylinder. (See fig. 14-17.)

When you reach the other end of the cylinder, remove the three lugs (B), shown in figure 14-16, and then slip the trailing edge blanket bar into the recess at the top of the cylinder gap. Replace the lugs, and beginning with the center, tighten them equally. As they are tightened, the blanket will be drawn taut, but you must be careful not to stretch the blanket too tight, as this will affect the quality of the printing. Check the blanket for stretch after a few hundred impressions, and tighten the lugs (B) again, if necessary.

Mounting the Plate

All pressmen raise the inking rollers when mounting the plate on this press and most of them thrown on the impression. A few leave the impression off.

To throw on the impression, you simply place a sheet of paper under the sheet detector finger so that it will not trip as you turn the press and then push down the lever (C), shown in figure 14-5.

To raise the ink rollers by hand, you must pull out on the knob (L), shown in figure 14-1, and swing the lever (K) over until it latches on the shaft for knob (L). The diagram in figure 14-18 will help to make this clear.

The method of mounting the plate varies with the model of the press. On some presses, the plate cylinders are equipped with pins like those shown in figure 14-19, and you can simply hook the plate over them. Other models have regular plate clamps similar to those found on the larger offset presses.

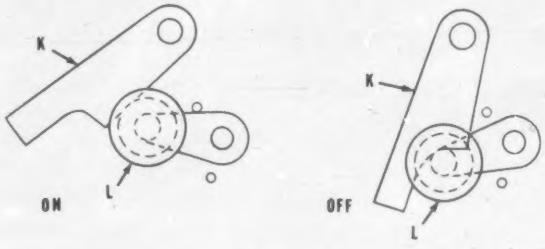
If your press is equipped with the pins, you should turn it until the cylinder gap is facing you. Then hook the top or gripper edge of the plate over the upper set of pins, as shown in figure 14-19. (The plate cylinder on this press is undercut 0.010 of an inch, and you should underpack the plate so that the plate and packing are 0.011 of an inch thick.)

When you reach the other edge of the cylinder, take a wrench and force the tail clamp down far enough to enable you to hook the tail end of the plate over the pins. You can do this by placing the wrench over the stud outside the bearer at the far end of the plate cylinder, as shown in figure 14-20. Once the plate is hooked over the pins, you simply release the stud and spring pressure will pull the clamp back into position. Then turn back to the gripper edge of the cylinder and tighten the setscrew at each end under the head clamp to draw the plate taut.

Figure 14-21 shows a diagram of a bar-type cylinder on a press equipped with the regular plate clamps. To mount the plate on this type of press, you should lift the ink rollers, throw on the impression, and turn the press until the cylinder gap faces you.

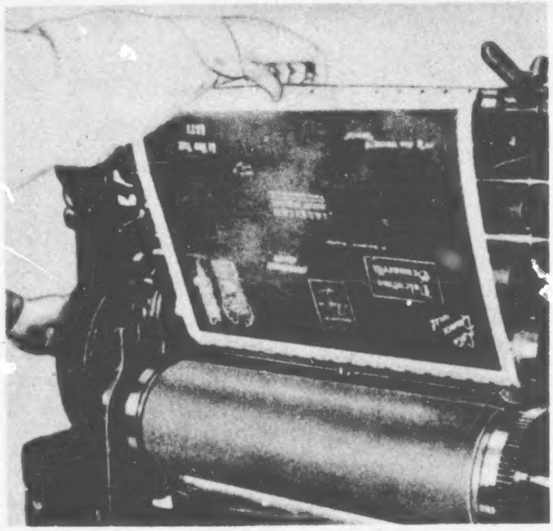
Next, loosen all the screws (A) in both plate clamps and turn bolts (E) and allen screws (F) until the clamps (B) and (C) are even with the edges of the cylinder. Then insert the gripper edge of the plate under clamp (B) and tighten screws (A) to hold it in place. Push clamp (B) up as far as it will go and tighten bolts (D) until they are snug. Slip the packing behind the plate (if any is required) and turn the press to draw the plate and packing around the cylinder.

When you reach the other end of the cylinder, insert the tail edge of the plate into clamp (C) and tighten screws (A). Then tighten the two allen screws (F) to snug the plate to the cylinder. At this point, you can throw off the impression by removing the paper from under the sheet detector finger and turning the press for one full revolution. Then loosen bolts (D) and draw the plate taut with the adjusting bolts (E). When the plate is taut, retighten bolts (D).



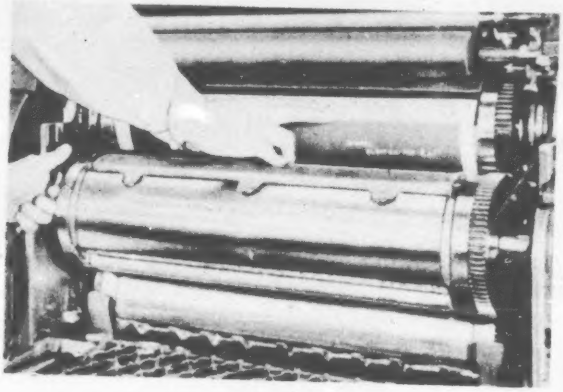
57.382X

Figure 14-18.—Lever and knob used in raising and lowering ink rollers (found on near side of press). Rollers are raised when lever (K) is hooked over the shaft of knob (L). Most operators swing lever (K) back with a clockwise turn until it is pointing toward the feeder end of the press during the run.

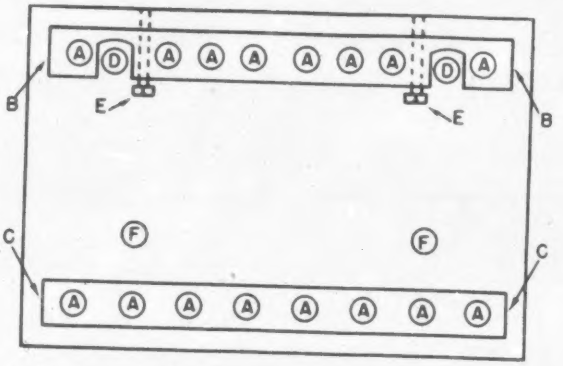


57.383X

Figure 14-19.—Hooking the gripper edge of the plate over the pins at the leading edge of the cylinder.



57.384X
Figure 14-20.—Hooking the trailing edge of the plate on pins at the lower edge of the cylinder.



A. Screws which hold plate in clamps.
B. Gripper clamp bar.
C. Trailing clamp bar.
D. Bolts.
E. Tension bolts for drawing plate taut or twisting it.
F. Allen tension screws.

57.385X
Figure 14-21.—Diagram of the plate cylinder on a press equipped with bar-type plate clamps.

Loosen the tail edge first when removing the plate after the run.

Quick-Change Plate Clamps

The latest models of this press are equipped with quick-change plate clamps which permit you to use any standard offset plate–zinc or aluminum, presensitized, plastic, or paper, both punched and straight-edged. (See fig. 14-22.) You can also use standard 10" X 15" duplicator plates with these clamps, if your work requires them.

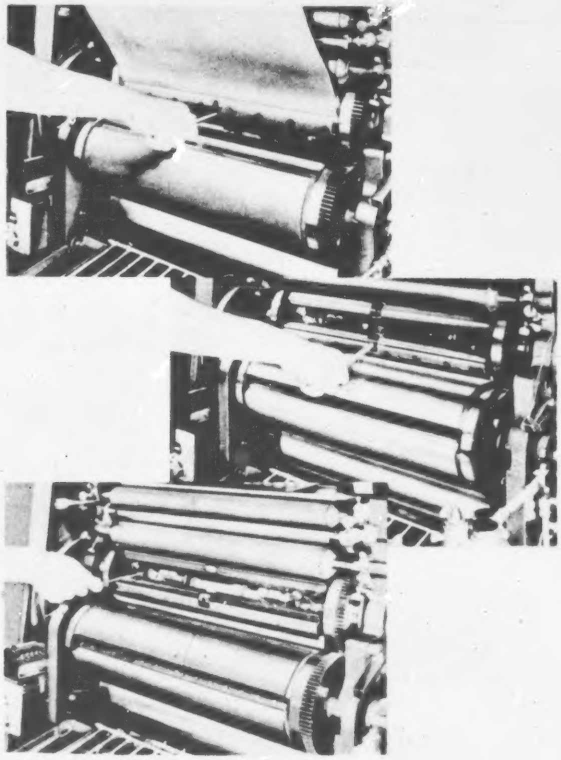
The screws (C), shown in figure 14-23, are used for adjusting the clamp to the thickness of the plate. There are eight of these screws on each clamp. Once they are set, it is not necessary to reset them until you change to a plate of a different thickness, as for example, if you switch from a presensitized plate to a plastic plate.

When mounting the plate on the cylinder, you should first insert the gripper edge of the plate into the upper clamp. When the plate is square against the stops, lock the clamp by inserting a pin wrench in cam (B) and rotating it.

Then inch the press until you can pull the plate straight out and insert the required amount of packing. Position the packing so that the edge protrudes slightly over the lead edge of the cylinder; then inch the press with the pressure on to wrap the plate and packing around the cylinder.

When you reach the cylinder gap again, take a wrench and force the tail clamp down far enough to enable you to insert the other end of the plate into the tail clamp. You can do this by placing the wrench over the lever (G), outside the bearer at the far end of the cylinder, as shown in figure 14-23, and pulling up until the toggle (H) locks. You can then insert the tail end of the plate into the clamp and lock the clamp with the pin wrench. Once this has been done, pull up on the toggle arm with the pin (J) to release the toggle. The spring-loaded lever will provide tension on the tail clamp to hold the plate taut. You can regulate the spring pressure with the adjusting nuts (K), shown in the illustration. You can use the knurled adjusting screws under the tail clamp to tighten the plate further, if necessary, when you are running close-register work.

You must adjust the clamps for the thickness of the plate if you change to a plate considerably thicker or thinner than the one previously



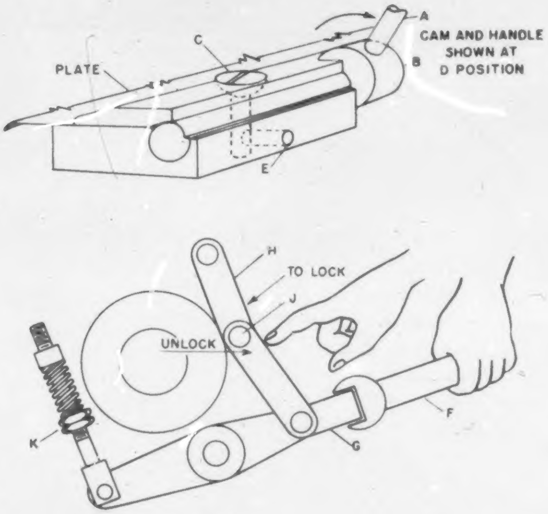
57.386X

Figure 14-22.—The plate clamp shown here is found on the newer models of the press. It will take either punched or straightedge plates.

used. To do this, loosen the locking setscrews (E) and the eight adjusting screws (C) shown in figure 14-23. Insert the new plate in the clamp and tighten the eccentric lock (B) with the pin wrench. Then tighten adjusting screws (C) and the locking setscrews (E). Adjust the other clamp in the same manner.

Positioning the Image

If the image does not print straight on the paper, you can make up to 1/8 of an inch adjustment by twisting or "walking" the plate on the cylinder. If this does not straighten the image sufficiently, you should have the plate remade.



A. Pin wrench.
B. Cam for locking clamp.
C. Adjusting screws used in setting clamp for thickness of plate.
E. Setscrew for adjusting screw (C).
G. Lever found at far end of plate cylinder. Used in lowering tail clamp.
H. Toggle.
J. Pin. Pull up to release toggle after plate is locked in tail clamp.
K. Adjusting nuts for regulating spring tension on tail clamp.

57.387X

Figure 14-23.—Diagram showing operating features of quick-change plate clamps.

To twist the plate on a cylinder equipped with pins or clamps, you simply adjust the screws under the plate clamps. To twist the plate on the bar-type cylinder you must loosen the two allen screws (F) and the two bolts (D) shown in figure 14-21. Then adjust bolts (E) until the image is positioned properly. Always retighten screws (F) and bolts (D) after twisting the plate.

You can raise or lower the image as much as 3/8 of an inch by shifting the undercut section of the cylinder. To free the undercut section, you must loosen the three bolts on the near end of the plate cylinder. Do not loosen these bolts completely, but allow them to exert a slight bind on the cylinder. Then rub your finger across the cylinder gear and onto the bearer so as to make a short grease mark on the bearer. You can use this mark as a reference point when you move the undercut section. Some pressmen use a grease pencil or felt-tip marking pen to make the reference mark.

Next slip a screwdriver or a block of wood in the cylinder gap and push the undercut section in a clockwise direction to lower the image or in a counterclockwise direction to raise it.

When the plate has been moved the desired distance, you should retighten the screws at the end of the cylinder.

Impression Cylinder

It is necessary to adjust the impression (pressure between the blanket and impression cylinder) each time you change from a light to a considerably thicker stock and vice versa. The two levers (H) and (I), shown in figure 14-24 are used for impression cylinder adjustments.

To change the impression, you simply unlock these levers; then raise lever (I) to reduce the pressure or lower it to increase the impression. Finally move lever (H) back against lever (I), and lock both in place with the clamps (A) and (C) shown in figure 14-24.

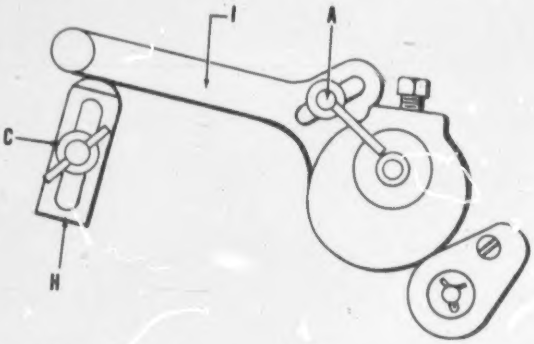
Adjustments for the impression cylinder grippers will be discussed later in this chapter.

DAMPENING SYSTEM

The dampening system consists of a water fountain, a fountain roller, a ductor roller, a distributing roller, and two form rollers. Notice that the ductor is smaller in diameter than the form rollers, and that the upper form roller is slightly longer than the lower form roller.

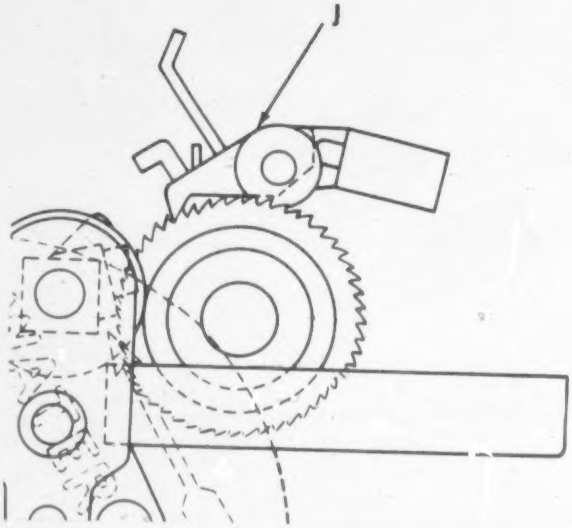
You can move the form rollers to the plate by turning the "water on" lever (M), shown in figure 14-1, toward the delivery end of the press.

The water feed is regulated by the ratchet adjustment (J) shown in figure 14-25. This mechanism, found on the far side of the press, regulates the speed of rotation of the fountain roller. You can increase the water supply by pushing the cam control lever (A), shown in figure 14-26, toward the feeder end of the press, or you can decrease it by moving lever (A) in the

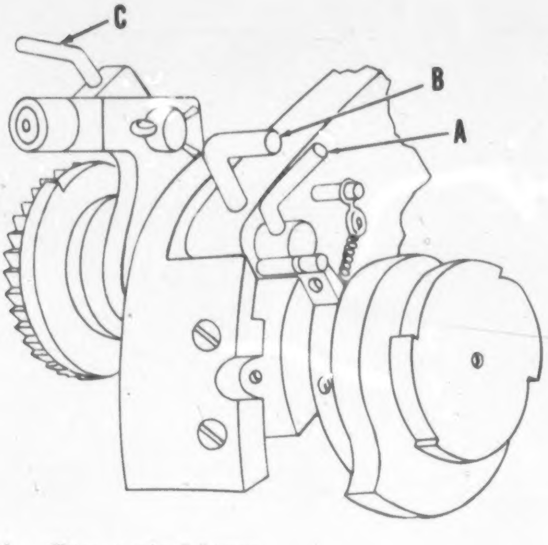


A. Clamp.
C. Clamp.
H. Stop for lever (I).
I. Lever used in setting impression.

57.388X
Figure 14-24.–Diagram of impression cylinder adjusting levers.



57.389X
Figure 14-25.–Ratchet pawl found on far side of press which regulates rate of turn of water fountain roller.



- A. **Cam control lever.**
- B. **Screw arm.**
- C. **Arm used in disengaging pawl from ratchet.**

57.390X
Figure 14-26.—Water feed adjustments.

opposite direction. Screw arm (B) acts as a lock for lever (A).

You can stop the fountain roller from turning and thus shut off the water supply completely by pushing lever (C), shown in figure 14-26, to disengage the pawl from the ratchet.

When necessary, you can use water stops, like those described in chapter 11, to control the moisture in local areas. You simply hook these stops over the side of the fountain and rest them against the roller. Then when the fountain roller turns, the stops will squeegee off some of the water and thus reduce the amount of moisture reaching the dampeners.

INKING SYSTEM

This press is equipped with 12 inking rollers, consisting of the fountain roller, ductor roller, 1 steel and 1 rubber rider roller, 2 rubber distributor rollers, 4 steel vibrators, and 2 form rollers. You can control the ink supply with the conventional fountain keys, which were discussed in chapter 11. The ink feed is further regulated by the setting of the pawl which engages the ratchet to turn the fountain roller. This ratchet assembly is located at the rear side of the press and is adjusted much the same as the one used in controlling the water feed. Latest models of the press have an extra roller (an auxiliary vibrator) to provide better ink coverage.

DELIVERY UNIT

The delivery unit consists essentially of delivery grippers, a set of automatic joggers, and a delivery board suspended between a set of chains which lower automatically as the sheets are delivered. Two delivery boards are generally provided so that when one is filled it can be removed and the other one can be inserted with a minimum of shut-down time.

Setting the Joggers

To set the joggers, you should run a sheet through the press, stopping just before it is released by the delivery grippers. Then turn the press until one set of delivery grippers is directly above the other. When the grippers are in this position, the side joggers will be at the end of their inward thrust. You can loosen both joggers by turning the L-shaped rods (H), shown in figure 14-9, and work them up to the edges of the sheet. Continue turning the press until the sheet is released; then set the jogger at the cylinder end of the delivery table by loosening the setscrew and moving it to the proper position.

Setting the Lowering Device

At the beginning of the run, you should raise the delivery table by hand until it is just below the bottoms of the joggers. You can raise it with the crank (S) shown in figure 14-1. Be sure that the ratchet is engaged before you release the crank so that the table will not fall.

After a few sheets have been run, you can raise or lower lever (U), shown in figure 14-1, to set the lowering device for the thickness of stock being run. Raising the handle causes the table to recede faster and vice versa.

Delivery Grippers

As you can see in figure 14-27, the delivery grippers are of the continuous-chain type discussed in chapter 11. Adjustments for these grippers are covered in the following section on maintenance and adjustments.

Press Maintenance

To insure that any piece of equipment is kept in good operating condition, constant attention must be given to preventive maintenance. The basic requirement for preventive maintenance of a printing press is proper lubrication. Other maintenance requirements include such items as washups, replacement of dampener roller covers, replacement of worn conveyor tapes, and the repair or replacement of worn or damaged parts.

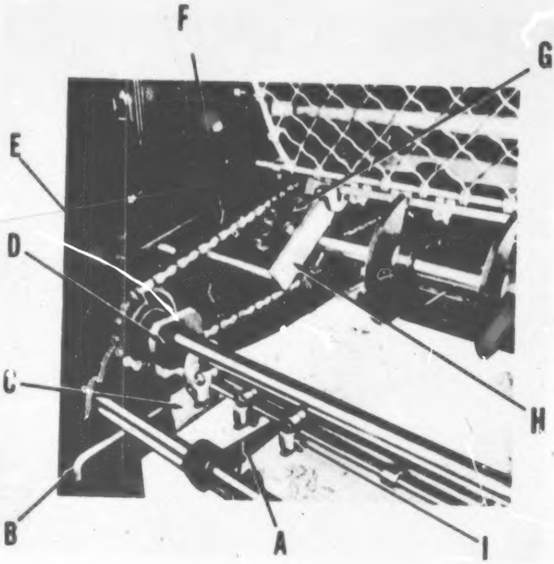
You should have a working knowledge of the Navy's Maintenance and Material Management System (3M), which is the program of equipment maintenance in use throughout the Navy. (General procedures used in the 3M system are discussed in chapter 18.)

The following pages detail the maintenance requirements and adjustments for the ATF 20 press which are used in support of the 3M system.

Lubrication

The chart shown in figure 14-28 shows the parts of the press that require lubrication and the type of lubrication recommended. Similar charts are sometimes attached to the side of the press.

Most operators oil the press at the beginning of each shift. Oil holes are generally marked with red paint, but if they are not, you should mark them so that they are readily apparent. Some oil holes, such as those on the impression cylinder gripper shaft, the back jogger rod, and the front guide cam roller, are rather difficult to find. You must turn the press to the proper position in order to reach them.



A. Stripper.
B. L-shaped handle used in positioning side jogger.
C. Side jogger.
D. Cam which causes delivery grippers to open and release sheet.
E. Sprocket wheel.
F. Delivery chain.
G. Sprocket wheel.
H. Cam which causes delivery grippers to open and receive the sheet.
I. Delivery grippers.

57.391X
Figure 14-27.—Delivery end of the press.

Always stop the press before attempting to oil or clean it. Begin at the same place each time and work all the way around the machine. Wipe off excess oil with a rag; don't allow it to drip or run down the sides.

Once a week, you should take a small, stiff brush and clean the dust and lint from all gears; then fill them with a fresh supply of gear compound or roller bearing grease. Go over the delivery gripper chains and the feeder drive chain once a week with S.A.E. No. 20 oil cut half and half with kerosene. Then wipe them off with a rag and oil them again with S.A.E. No. 20 oil. The vacuum pump motor bearings should be oiled weekly and the reservoir on the pump should be kept filled with oil.

Use S. A. E. No. 20 Motor Oil for:	
Main bearings	Daily, check constantly
Ink and water roller bearings	Twice daily or every four hours
Side guide-bar bearings	
Impression cylinder oil holes	Daily
Connecting links and pins	Daily
Headstop cam roller	Daily
Feed cam roller	Daily
Sucker bar (2 rollers)	Daily
Sheet detector cam roller	Daily
Vacuum valve cam roller	Daily
Ink ductor bearings	Daily
Gripper bars (3)	Daily
Side jogger rods	Daily
Drop guide bearings	Daily
Back jogger rod	Daily
Push guide bearing	Daily
Air pump reservoir oil cup	Daily
Steel ink fountain roller bearings	Daily
Delivery shaft bearings	Daily
Flywheel shaft bearings	Daily
Ink vibrator crank gear	Daily
Ink drive intermediate gears	Daily
Air pump motor oil bearings	Weekly
Use Penetrating Oil or mixture of equal parts of kerosene and S. A. E. motor oil for:	
Delivery chains	Weekly
Feeder drive chain	Weekly
Use Surett Compound No. 2500 for:	
Gears	Weekly
Press motor	Twice Yearly (every 1000 hours)
Use Castroleum No. 1 for:	
Impression cylinder tumbler pins	Daily

57.392X

Figure 14-28.—Lubrication chart for the ATF 20 and 20A presses. If the press is included in PMS, consult the applicable Maintenance Requirement Card (MRC).

Cleaning Operations

At the end of the day, you should remove the ink from the fountain. Then remove the fountain blade by loosening the two bolts which hold it in place. Clean the blade and all parts of the fountain thoroughly with roller wash.

Next, hook the washup attachment over the bars at the end of the fountain and clean the rollers by the same method as that used in cleaning the rollers on the smaller presses. After the rollers are clean go over them with a rag, paying particular attention to the ends. If they are not thoroughly cleaned, they may become glazed with dried ink.

Changing the Covers on the Dampeners

You have already seen, in preceding chapters of this book, how to clean cloth-covered dampeners. If paper covers are used on the form rollers, they are generally discarded when they become dirty.

As a rule only one set of cloth covers are used on the dampener rollers. However, two coverings are used on the rollers of some presses. On these presses, the inner coverings generally consist of flannel, which is handled the same as the outer molleton covers except that it is stretched without wetting. Seamless muslin tubing is used for covering the fountain roller on some presses.

Some pressmen use a paper cover on the lower form roller and a molleton cover on the upper roller to absorb any excess moisture.

Always clean inside the cylinder gaps and along the bearers of the plate and blanket cylinders. The other operating parts of the press, such as the feeder guides and suction lines, require a thorough cleaning periodically.

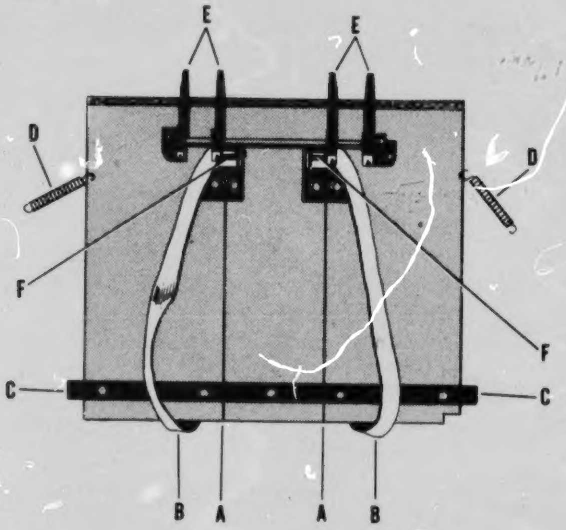
Changing Worn Conveyor Tapes

You have seen earlier in this chapter that the conveyor tapes must be replaced when they become damaged or worn with use. The procedure for changing them sounds rather complicated, but is actually fairly simple once you have done it a time or two. You simply loosen the feedboard and tape rollers and then slip the tapes through the slots in the feedboard.

In removing the tapes, you must loosen the impression trip connecting link (under the cylinder end of the feedboard) and the two springs (D) shown in figure 14-29. Next, loosen the front support brackets and swing them back to the feeder end of the press. Then release the tension on the tape pulleys.

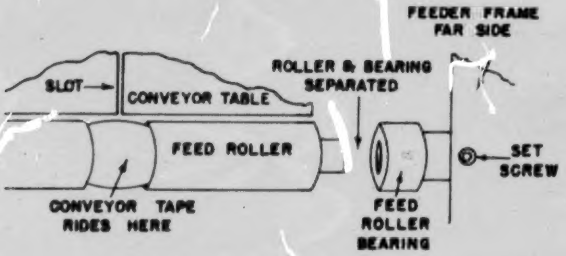
After this, loosen the setscrews at each end of the drive roller, shown in figure 14-30, and push the bearing out to release the roller. Slip off the drive chain and then remove the roller from the press. Finally loosen the screws holding the support bar (C), shown in figure 14-29, and remove the feedboard.

(Always mark each part as you remove it from the press so that you will be sure to get it back into its proper place.)



A. Slots used in changing conveyor tapes.
B. Conveyor tapes.
C. Support bar.
D. Springs
E. Undertongues.
F. Front tape rollers.

57.393X
Figure 14-29.–The underside of the feedboard.



57.394X
Figure 14-30.–Removing the tape driver roller at feeder end.

Once you have loosened the feedboard, you simply remove the support bar (C) and front tape rollers (F), shown in figure 14-29, and then slip the tapes through the slots (A).

Reverse the procedure just described when putting on the new tapes. In replacing the front tape rollers be careful not to set them in too far toward the undertongues, as this will cause undue wear on the tapes.

Timing the Cylinders

The cylinders are positioned in the proper relationship to one another when the press is assembled. The gear at the near end of the plate cylinder is pushed counterclockwise as far as it will go. The blanket cylinder is then set to clear the impression cylinder grippers by 1/16 of an inch, and the trailing edge of the plate cylinder is set even with the back edge of the blanket cylinder.

As a rule, these cylinders will require no adjustments for position unless the press is overhauled or an accident occurs that requires their removal from the press. If it is necessary to reset them, you should refer to the diagrams shown in figure 14-31.

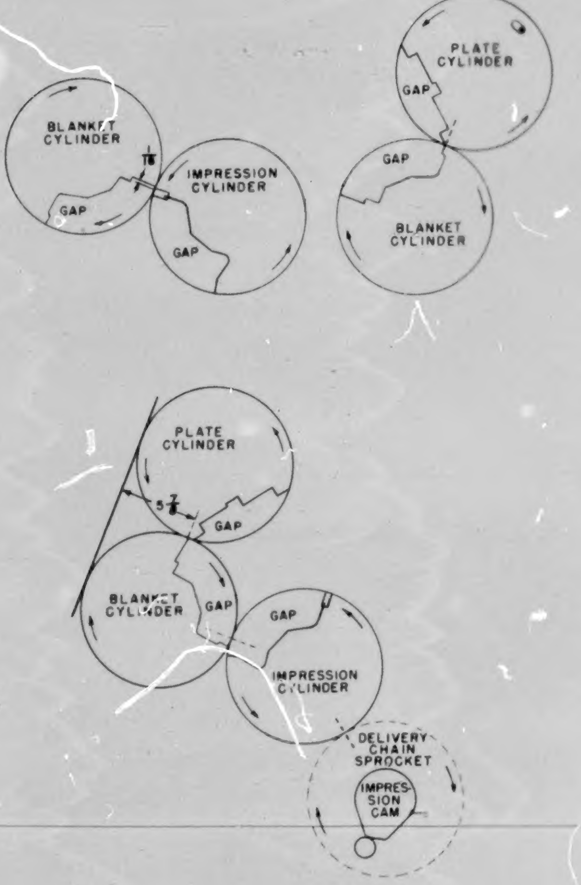
Timing the Feeder

If the feeder gets out of time with the printing unit, the sheets will arrive at the front guides too late to be caught by the cylinder grippers, or they will arrive too soon and shoot into the printing unit before the grippers open. You can change the timing, when necessary, by shifting the drive chain one sprocket tooth forward or backward.

Timing the Front Guides

Figure 14-32 shows the adjusting screws used in regulating the action of the front guides. When the guides rise, they should clear the impression cylinder by 1/8 of an inch. You can regulate this clearance by loosening the screws (A), shown in the illustration, and rotating the shaft to which the guides are attached.

The stop screw (B) regulates the distance the guides drop. The plate (E), shown in figure

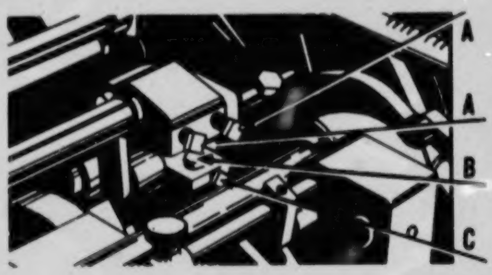

BLANKET CYLINDER
1/16
IMPRESSION CYLINDER
GAP
GAP
PLATE CYLINDER
GAP
GAP
BLANKET CYLINDER
PLATE CYLINDER
5 7/8
GAP
BLANKET CYLINDER
GAP
GAP
IMPRESSION CYLINDER
DELIVERY CHAIN SPROCKET
IMPRESSION CAM

57.395X
Figure 14-31.—Diagrams showing correct positioning of press cylinders.

14-12, should project about 1/16 of an inch below the undertongues when the guides are down.

. There should be 1/32 of an inch clearance between the front guides and the gripper bar when the cylinder grippers are closed. You can regulate this clearance with the front guide cam at the far end of the impression cylinder. This cam is also used in timing the lift of the guides.

The timing of the side guides is factory set and should not be changed.



A. Lock screws for front guide shaft.
B. Stop screw.
C. Lock screw.

57.396X
Figure 14-32.—Adjusting screws for timing the lift of the front guides.

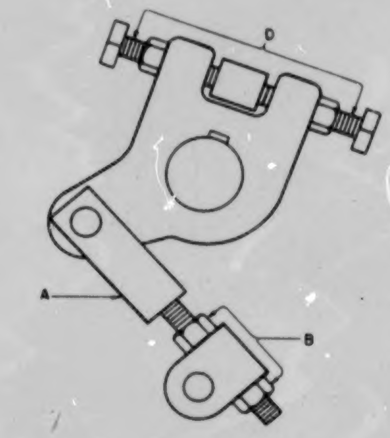
Paralleling the Cylinders

You can adjust the pressure between the plate and blanket cylinder bearers in the following manner. Mount a plate and blanket on the press, adding the proper amount of packing to produce the recommended printing pressure. Next, bring the cylinders together by throwing on the impression.

You can then adjust the pressure between the cylinder bearers with the adjusting mechanism found on the far side of the press. (See figure 14-33.) Loosen one of the locknuts (B) and tighten the other to move the arm (A) up or down. This forces the blanket to or away from the plate, and thus increases or decreases the tension.

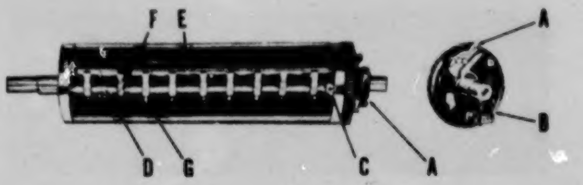
Use the following method to check the new setting. Place a spot of ink on each of the plate cylinder bearers and then throw on the impression and turn the press for one revolution. If the spots transfer to the bearers of the blanket cylinder without losing their shape, the setting is correct.

However, if one spot transfers properly while the other fails to transfer or is mashed out of shape, the cylinders are not parallel and you must parallel them by adjusting the bolts (D) shown in figure 14-33.



A. Pressure arm.
B. Adjusting nuts for regulating pressure.
D. Adjusting bolts for paralleling cylinders.

57.397X
Figure 14-33.–Adjusting nuts for setting blanket-to-plate pressure and for paralleling cylinders.



A. Tumbler.
B. Spring.
C. Collar.
D. Gripper shaft.
E. Gripper rest bar.
F. Gripper finger.
G. Setscrew.

57.398X
Figure 14-34.–Impression cylinder grippers and tumbling mechanism.

You can check the pressure between the impression cylinder and blanket by using paper feelers, as described in previous chapters. Place the feelers at each end between the two cylinders. Then throw on the impression and test the drag on the feelers. If they are not held with equal tension, the cylinders are not parallel and you must parallel them with the adjusting screws on the far side of the press. These screws are similar to those shown in figure 14-33.

Adjusting the Impression Cylinder Grippers

Figure 14-34 shows a closeup of the tumbling mechanism that causes the impression cylinder grippers to open. As the cylinder revolves, the tumbler (A) is engaged by a pin attached to the press frame. The pin forces the tumbler to rotate, turning the shaft (D) to which the gripper fingers are attached. As this shaft turns, it forces the grippers to open.

You should check these grippers occasionally to see that they are all closing on the paper with equal tension. To reset the grippers, you should loosen each finger until it turns easily on the shaft. Then tighten both end grippers against the gripper rests. Next, place a screwdriver against the tumbler and tilt the shaft enough to insert a 0.003-inch paper feeler under the two end grippers. Then working from the center out, set each individual gripper lightly against its rest.

After they have been set, remove the paper feelers and tighten the two end grippers snugly against their rests. Finally, test the setting of all the grippers with paper feelers to see if the tension is even.

Delivery Grippers

The delivery grippers should clear the leading edge of the impression cylinder by 1/32 of an inch. You can regulate this clearance by adjusting the sprocket wheels over which the drive chains travel.

Adjusting the Ink Rollers

Most operators remove all but the stationary ink rollers from the press when making adjustments for roller tension, and then adjust each roller properly as it is replaced.

To set the form rollers, you must mount a plate on the press with the proper amount of packing. Then put the form roller on the delivery side of the cylinder (No. 1 in fig. 14-35) in the press and drop it on the plate against 0.003" paper feelers, as described in previous chapters.

Test the tension on the feelers. They should be held with a light, even pull. If they are not, you must adjust the near and far ends of the roller with the adjusting screws shown in figure 14-35.

Loosen the locknut (D) and adjust the thumbscrew (A) at each end of the roller until the drag is even on both paper feelers.

Next, place feelers between the form roller and the (stationary) vibrator roller (No. 3). Loosen the locknut (E) and adjust the form roller to the vibrator, as necessary with the thumbscrews (B) at each end of the roller. Finally retighten the locknuts for screws (A) and (B). Remove the paper feelers and turn the press for one revolution. Insert the feelers again and test the drag. (Turn press until form rollers are in cylinder gap when testing tension between form rollers and vibrators.)

Adjust the other form roller (No. 2) in the same manner.

Test the rollers after the press has been inked by dropping them against a dry plate. They should leave a streak about 1/8 of an inch wide and even from end to end.

The thumbscrews (C), shown in figure 14-35, are used for setting the distributing rollers. Place feelers between the two distributing rollers (Nos. 5 and 7) and adjust with thumbscrews (C) at each end of roller No. 5 until the pull is even on both feelers. Adjust the distributing rollers (Nos. 6 and 8) on the feeder side in the same manner.

The ductor roller (No. 11) has only one adjusting screw. This square headed screw (G), located on the far side of the press, regulates the tension between the ductor and the fountain roller. A clockwise turn increases the pressure and vice versa.

On the newer presses, the rider roller No. 10 is equipped with a hold-down device which can be adjusted to prevent roller No. 9 from bouncing as the ductor roller swings back and forth.

Adjusting the Dampener Rollers

The dampener rollers are set to the plate and to one another with paper feelers much the same as the inking rollers. Move the rollers out of contact with the plate and then set the lower short dampener form roller to the vibrator with the thumbscrews (A), shown in figure 14-36. You will find one of these thumbscrews at each end of the roller.

Next, set the roller to the plate. Throw the rollers "on" and then adjust the form roller at both ends with the wing nuts (B).

The upper long dampener form roller is set to the vibrator roller with thumbscrews (D) on each side of the press, and it is set to the plate with thumbscrews (C). The rollers should be out of contact with the plate when the form roller is set to the vibrator and should be in contact with it when the form roller is set to the plate.

The ductor roller is set to the fountain roller with an adjusting screw on the far side of the press. You can increase the pressure between the ductor and the vibrating roller by adjusting a screw on the end of the spring which draws it against the vibrator. This spring is also located on the far side of the press.

The fountain roller and the vibrator are chromium plated on the newer models of the press and are brass on the older models. These rollers are stationary and require no adjustments.

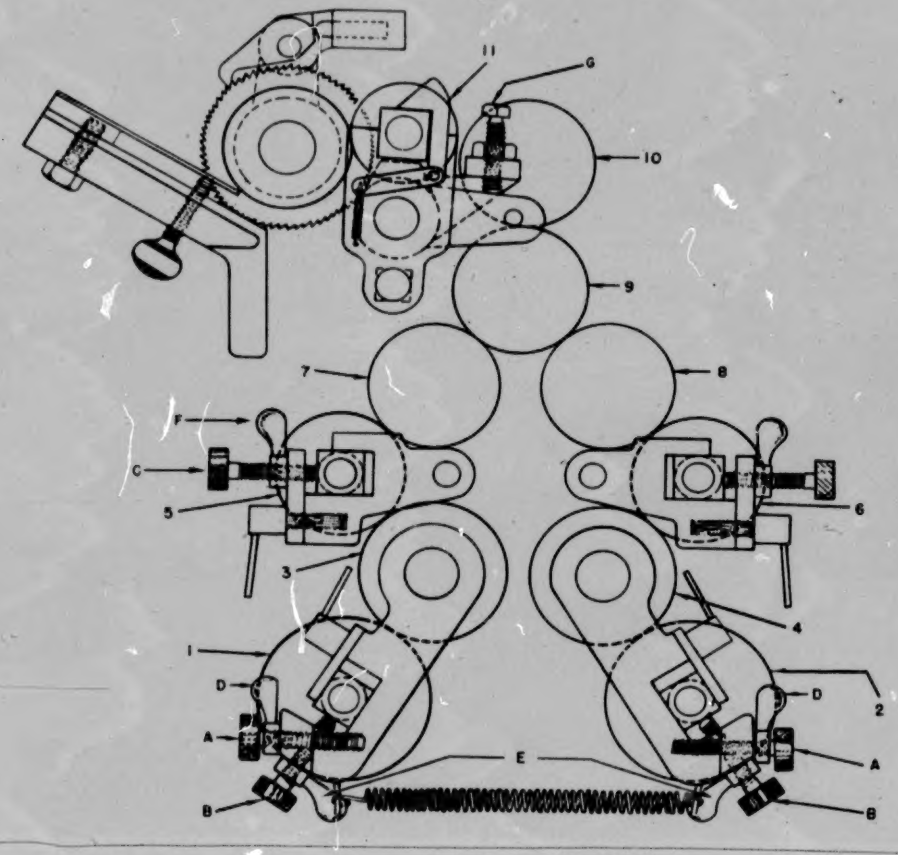
Be sure the ink rollers are raised and the Water-On Lever is in its off position when you remove or replace the dampener form rollers.

CHIEF 20A

Figure 14-37 shows the operating controls on the Chief 20A, the latest 14" X 20" press put out by the American Type Founders. It is similar in many respects to its predecessors; however, it has certain new features not found on the older models. For example, all of the operator's controls are located on the near side of the press. It also has changes at both the delivery and feeder ends of the press. Study figures 14-37 through 14-44 for a moment until you are familiar with the location and functions of each of the operating controls.

Feeder Unit

The handwheel (A) shown in figure 14-38 allows you to change the speed (from 3,500 to 5,500 impressions per hour) while the press is in



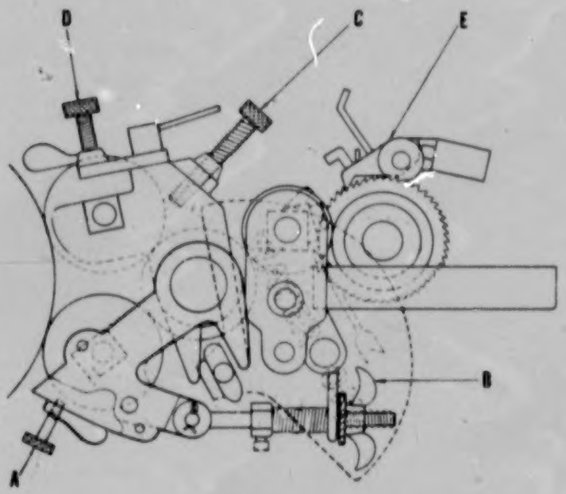
A. Adjusting screw for setting form roller to plate.
B. Adjusting screw for setting form roller to vibrator.
C. Adjusting screw for setting one distributor roller to another.
D. Half-wing locknut for screw (A).
E. Half-wing locknut for screw (B).
F. Half-wing locknut for screw (C).
G. Screw for adjusting ink ductor roller to the fountain roller.

57.399X

Figure 14-35.–Adjusting screws for ink rollers. Older models of the press have 12 rollers and later models have 13; however the auxiliary vibrator found on the later models ordinarily needs no adjustment. (See fig. 14-45.)

operation. The pointer and scale (B) indicate the press speed.

To lower the feed table, raise lever (D) and turn handle (F) counterclockwise. The stock is loaded onto the feed table 1/8 of an inch off center. The side piling bars are set to clear the stack by 1/32 of an inch on each side. The setting of the feed table controls is similar to that described for the Chief 20. The pile height governor latch (M) shown in figure 14-39 must be in its up position when the pile height governor is adjusted. When this latch is pushed down, the pile height governor will not operate and the pile will not raise.



A. Screw used to set bottom dampener form roller to vibrator.
B. Screw used to set bottom dampener to plate.
C. Screw used for setting top dampener form roller to plate.
D. Screw used for setting top dampener to vibrator.
E. Ratchet pawl found on far side of press. Regulates speed of rotation of fountain roller.

57.400X
Figure 14-36.—Adjusting screws for dampener rollers.

Suction

This press has four sucker feet and comes equipped with two sets of suckers. You should use the rubber suckers for heavy work and the metal suckers for the average run of work. When using the metal suckers, be sure the wide end of the V-shaped groove on the bottom of each foot is facing the cylinders.

When adjusting the suction, inch the press until the suckers are all the way down. Then start the blower and push down the feeder control handle (G), shown in figure 14-38. If the suction is correct, the top sheet will be caught and held by the suckers. You can adjust the suction, if necessary, with the knob (P) shown in figure 14-39.

Blast

You can regulate the blast with the knob (Q), shown in figure 14-38, and with a petcock provided on each of the side nozzles (B) shown in figure 14-40. You should adjust the height of the side nozzles so only the top three or four sheets are lifted. The center blast nozzle (D) should be set so that it is 1/8 of an inch higher than the bottom of the sucker feet. You can raise or lower it with the lever (E) shown in figure 14-39.

Side Guide

The side guide should be set to move the stock approximately 1/8 of an inch when the sheet is side guided. Adjustments for the side guide are similar to those discussed earlier in this chapter.

Front Guide

The front guides vary slightly in construction from those found on the Chief 20. (See fig. 14-44.) You can lessen the gripper margin by turning the knurled adjusting screw (C) clockwise. The adjustment (B) is used to regulate the distance between the spring (A) and the undertongues.

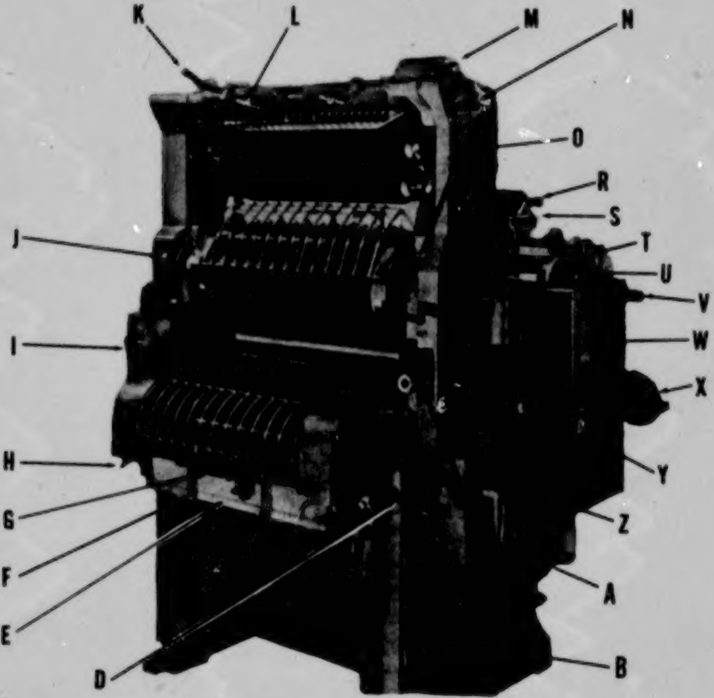
You should not lengthen your margins beyond the gripper bar and should not attempt to run sheets with less than 3/16 nor more than 5/16 of an inch gripper bite. Do not attempt to use the front guides to straighten the work on the sheet.

Plate and Blanket Cylinders

The plate and blanket cylinders on the Chief 20A are similar to those found on the later models of the Chief 20. The blanket cylinder is undercut 0.071 of an inch, and the plate cylinder is undercut 0.012 of an inch.

The blanket is mounted on the Chief 20A in the same manner as it is on the Chief 20.

The plate cylinder is provided with quick-change plate clamps like those shown in figure 14-23. You have already seen how to mount the plate on presses having this type of clamp.



57.401X

A. Handle for raising and lowering delivery platform.
B. Adjustment for regulating pressure between impression cylinder and blanket.
C. Handle used in setting lowering device for manual or automatic operation.
D. Handle used in regulating rate of descent of delivery platform.
E. Delivery platform (dolly).
F. Paper stops. Lift to bring sheet catcher into use.
G. Sheet catcher.
H. Adjustment rod for delivery joggers.
I. Delivery-end control panel.
J. Ink trip lever. Lift to cause ductor to operate when press is off impression. When impression goes on handle will return to automatic position. Lift handle and push up to stop motion of ductor when impression is on.
K. Lever for turning fountain roller by hand.
L. Ink fountain blade screws. Loosen to remove blade for cleaning.
M. Ink volume control handle. Regulates rate of turn of fountain roller.
N. Handle which stops fountain roller from turning, shutting off ink supply.
O. Impression trip. Used in tripping off impression from delivery end of press.
P. Lever for raising and lowering ink form rollers.
Q. Lock for locking ink form rollers up.
R. Water volume control handle. Regulates rate of turn of fountain roller.
S. Handle for moving dampeners to or from plate.
T. Adjustment for middle blast pipe.
U. Feeder-end control panel (start, stop and inch buttons.)
V. Handle for raising and lowering feed table.
W. Switch for vacuum pump.
X. Speed control handwheel. Adjust when press is running.
Y. Speed control dial and pointer.
Z. Feeder control lever (hidden). Push down to start sheets feeding. Continue to hold down until first sheet passes detector finger so impression will go on.

Figure 14-37.—Operating controls on the Chief 20A.

The plate cylinder is equipped with a center pin and two side bumper blocks which are used in positioning plates when the Carlson Register Punch System is used. (This system permits continuous register control of multiple images from stripper to platemaker to press, when the plate and goldenrod layout are both punched for registration purposes.) When you are running jobs that do not involve this method of registration, you can remove the pin from the cylinder by loosening a setscrew.

Stock Thickness Adjustment

The knob (E) shown in figure 14-43 enables you to change the impression while the press is running. The gauge is calibrated to allow you to set the impression for the thickness of the stock being run. Since a pressure of 0.003 inch is required to print properly, you must add this amount on to the thickness of the stock when you make your setting. Thus, if your stock is 0.003 of an inch thick, you should set the pointer at 0.006 on the scale. When setting the pointer, move it first to 0.008; then move it back to 0.006, as this will ensure a more accurate setting.

Delivery Unit

This press is equipped with an automatic receding stacker that lowers the delivery pile to the floor. Two delivery boards with casters (dollies) are provided. When one is filled, you simply roll it away and place the other one in the press.

You can raise the delivery platform by pulling out on knob (B) shown in figure 14-43 and turning handle (A) clockwise. You should raise the platform until it touches the bottom of the joggers at the beginning of the run and leave knob (B) pulled out so the delivery platform will not lower automatically until about an inch and a half of paper has built up inside the joggers. Then push knob (B) in to its automatic lowering position.

Knob (C) regulates the rate of descent of the delivery platform. You should set it to the adjacent scale for the thickness of the stock being run.

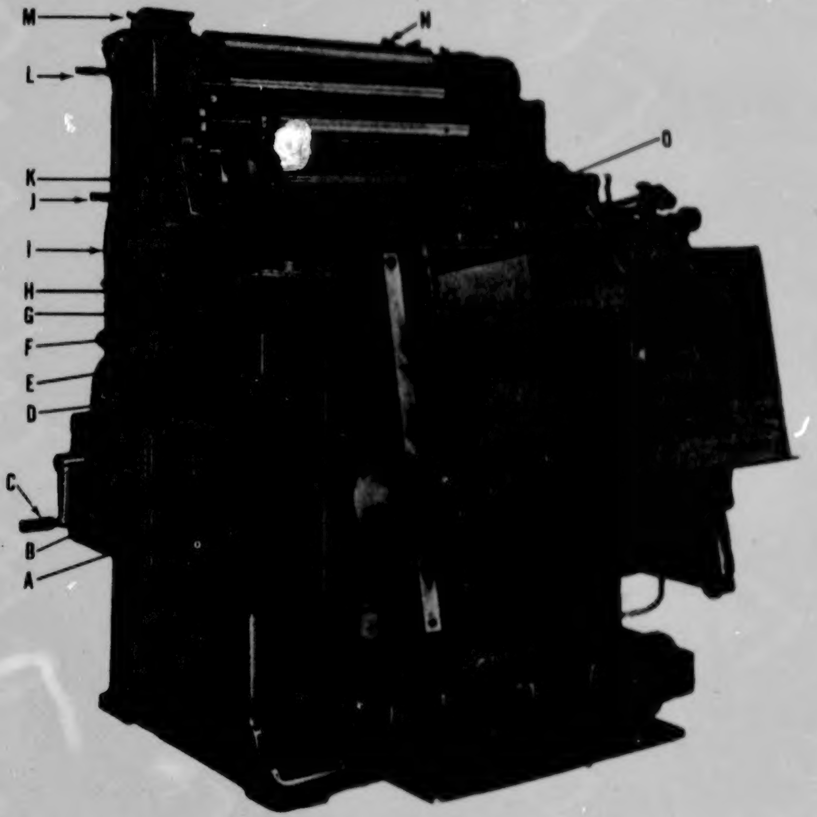
A flanged device, known as the sheet catcher, is provided for removing sheets for inspection while the press is running. If you lift the front paper stops (F) shown in figure 14-37, this device catches the next sheets fed through and holds them above the delivery pile until you can remove the top sheet from the pile.

Inking Unit

The lever (N) shown in figure 14-38 is for turning the ink fountain roller manually. Handle (L) can be used to stop the motion of the fountain roller to shut off the ink supply during the run without disturbing the fountain setting. The ink feed control (M) regulates the throw of the fountain roller. You should set it at 10 for maximum ink and set it at zero to cut off the ink supply.

Handle (I) is for raising and lowering the ink form rollers. Move it to its "on" position to lower the rollers. When the plunger is engaged in its operating mechanism, the handle will operate automatically with the impression. You can pull out the knurled handle and lift it to drop the form rollers when the impression is off. When the press goes on impression, the handle will return to its automatic position. You can also use the handle to raise the rollers when the impression is on.

The ink lock-up handle (J) locks the rollers so that they will not drop when the impression is



57.401(57B)AX

A. Press speed control handwheel. Pointer and scale (B) indicate press speed. Change speed only when press is running.
B. Press speed pointer and scale.
C. Handle for raising and lowering delivery platform.
D. Ratchet release for handle (F)
E. Switch for vacuum pump.
F. Handle for raising and lowering feed table. To lower raise lever (D) and turn counterclockwise.
G. Feeder control handle. Push down to close suction by-pass hole and latch the impression handle (H) in "on" position. Hold down until first sheet passes under sheet detector to throw on impression.
H. Impression throw-off lever.
I. Handle for raising and lowering ink form rollers. Move to "on" position to lower rollers. When plunger is engaged in its operating mechanism, handle will operate automatically with the impression. You can pull out the knurled handle and lift it to drop form rollers when impression is off. When press goes on impression, handle will return to automatic position. You can also use handle to raise rollers when impression is on.
J. Ink lock-up handle. Pull out handle (I) and rotate handle (J) counterclockwise to lock so that form rollers will not drop when impression is put on.
K. Handle for moving dampener form rollers to or from plate.
L. Handle for stopping motion of ink fountain roller to shut off ink supply during run.
M. Ink feed control. Set at 10 for maximum ink; set at zero to cut off ink supply.
N. Handle for turning ink fountain roller manually.
O. Feeder end control panel (start, stop, and inch buttons).
P. Side piling guide.
Q. Knob for adjusting blast.

Figure 14-38.—Feeder end of Chief 20A press.

thrown on. To lock, pull out handle (I) and rotate handle (J) counterclockwise.

You can remove the blade from the ink fountain for cleaning by loosening the two T-bolts (L) shown in figure 14-37, and sliding it out. This press is equipped with a wash-up attachment which is held in place on posts with adjusting knobs above the plate cylinder at the delivery end of the press. You can remove the wash-up attachment from the press to clean it when necessary.

The Chief 20A has 13 inking rollers. The extra oscillating roller (M) shown in figure 14-45 is used to provide better ink distribution for solids and halftones. One of the form rollers is slightly larger than the other to ensure proper coverage of the plate.

You can adjust the two form rollers (K) and (L) and the two distributor rollers (G) and (H) with knurled adjusting screws similar to those found on the Chief 20 presses. The four vibrating steel rollers (E, F, I, and J) are not removable and need no adjustment. The rider roller (C) and top distributor roller (D) are equipped with a hold-down adjustment to keep them from bouncing. The ductor roller is adjustable and the auxiliary vibrator (M) is equipped with caps and locknuts which prevent it from bouncing when the impression goes on. The sockets, roller journals, and all bearing blocks are stamped with numbers and you should match these numbers to ensure the proper location of rollers and bearing blocks in the press. The odd numbers go on the far side of the press and the even numbers on the near side.

Begin with roller (K) when setting the form rollers. Place paper feelers between it and the vibrator and then adjust by loosening the half-wing locknuts and turning the knurled head screw at each end until there is sufficient drag on both paper feelers. Tighten the locknuts and also tighten the locknuts on the flat caps which hold the bearing blocks in the sockets.

After this, place paper feelers between the plate and form roller and move the roller against the plate. Loosen the half-wing locknuts and turn the knurled adjusting screws as necessary to provide the proper drag on the feelers. Then retighten the locknuts.

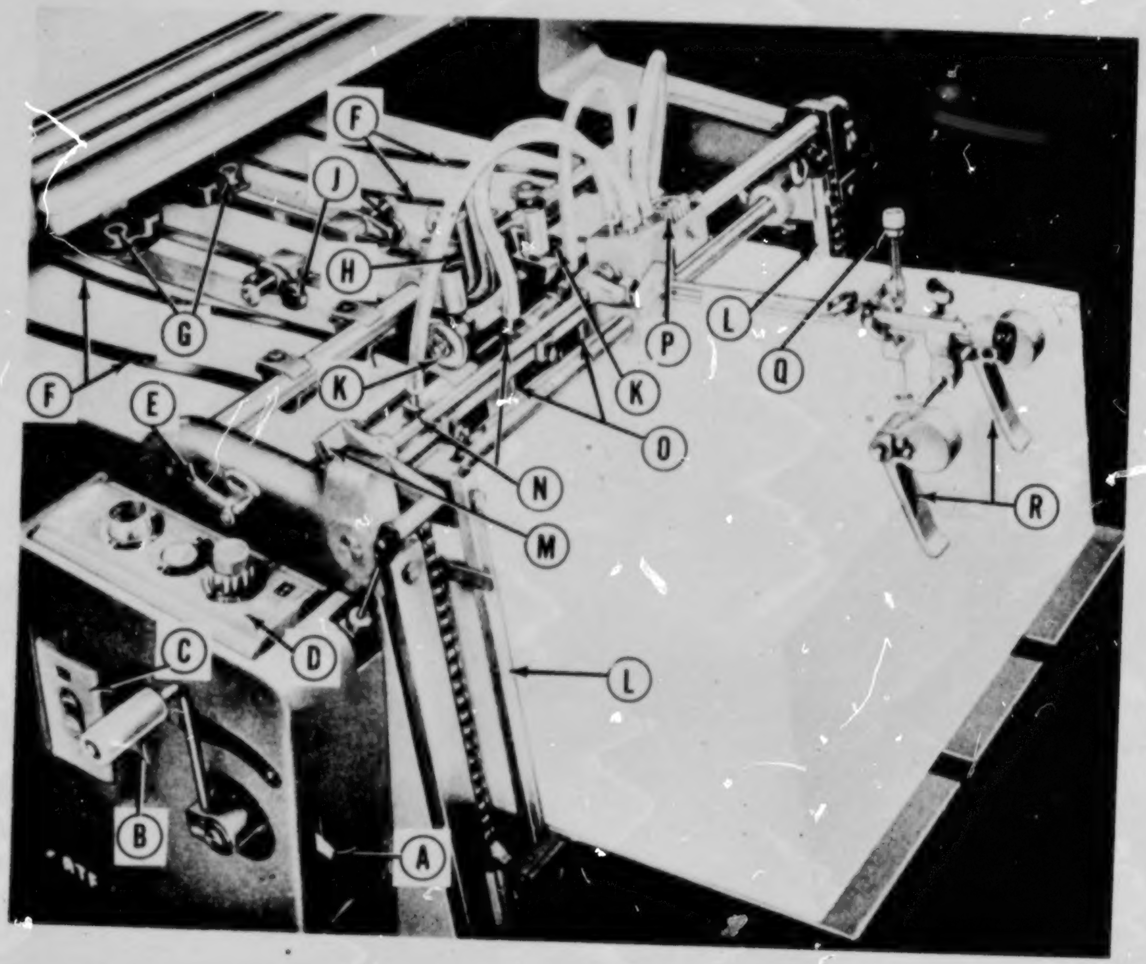
Follow the same procedure in adjusting roller (L). Roller (L) should be set against the plate with slightly more tension than roller (K).

Once the form rollers are set, you should place distributor roller (G) in its sockets and tighten the caps with the half-wing locknuts. Place paper feelers between roller (G) and rollers (I) and (E). Adjust the knurled head screws until there is a light drag on each of the four strips of paper. Then tighten the locknuts. Repeat this procedure for distributor roller (H).

Next place distributor roller (D) in the press and install the rider roller (C) in the same slots. Place paper feelers between the rollers and adjust the knurled head screws to obtain the proper drag on the feelers.

Place the ink ductor roller (B) in its sockets and tighten the caps with the half-wing nuts. Move the ductor throw-off handle (J) shown in figure 14-37 to its "on" position. Turn the press with the handwheel until the cam roller is on the high dwell of the ink ductor cam (located outside the gear side frame on the plate cylinder shaft). Place strips of paper between the ductor and the fountain roller. Then turn the square-head adjusting screw at each end of the roller to obtain the proper drag. Lock the jam nuts on the adjusting screws.

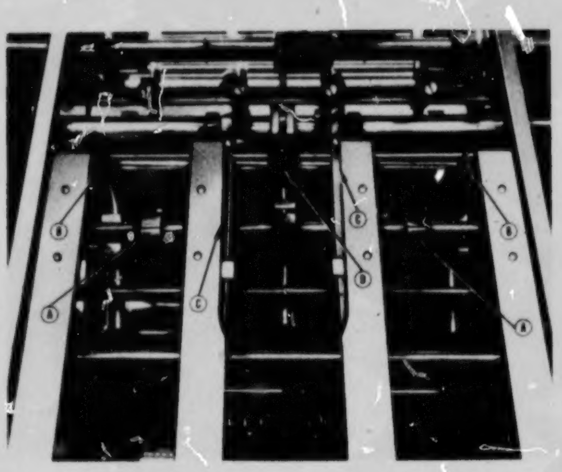
The auxiliary vibrator roller (M) shown in figure 14-45, should be locked in place with the caps and half-wing nuts. The adjustment for the stroke of the vibrator rollers is located on the far side of the press near the plate cylinder shaft. A slotted disk drives the vibrator rollers by a connecting rod and a drive bolt. To adjust, turn



A. Ratchet release for handle (B).
B. Handle for raising and lowering feed table.
C. Switch for vacuum pump.
D. Feeder-end control panel.
E. Lever used for raising and lowering center blast pipe nozzle.
F. Sheet hold-down bands.
G. Guide ball holders.
H. Caliper.
J. Speed driver wheels.
K. Forwarding rollers.
L. Side piling guide.
M. Pile height governor latch. Pile height governor will not operate and pile will not raise when latch is pushed down. Latch must be up when pile height governor is adjusted.
N. Sucker feet. There are four on this press.
O. Sheet separators are similar to those found on Chief 20.
P. Knob used in adjusting suction.
Q. Pile height governor.
R. Tail guides.

Figure 14-39.–Feed table on the Chief 20A.

57.651X



A. Tape tension pulleys for adjusting tension on conveyor belts.

B. Side blast pipes. A petcock is provided on each of the nozzles to control amount of blast.

C. Separator finger.

D. Center blast nozzle. Can be raised or lowered with lever (E) shown in figure 14-39.

57.652X

Figure 14-40.—Front piling guides and sheet separation mechanism.

the press until the slot is in a horizontal position. Then loosen the drive bolt and move it to or away from the center of the disk The length of the stroke can be changed from 0 to 5/8 of an inch. When the bolt is at the center of the disk there is no motion at all, and the length of the stroke is increased as the bolt is moved away from the center.

DAMPENING UNIT

The water feed control (B) shown in figure 14-41, controls the distance the fountain roller turns in the pan with each revolution of the press. Set it at No. 14 for maximum water feed and at zero to cut off the supply of water entirely. The knob (G) is for turning the water fountain roller manually. A brake operates in connection with knob (G) to stop the fountain roller at the proper point each time it rotates. You can regulate the tension on this brake with an adjusting screw. You should not set it so tight that it cannot be turned with reasonable force on knob (G).

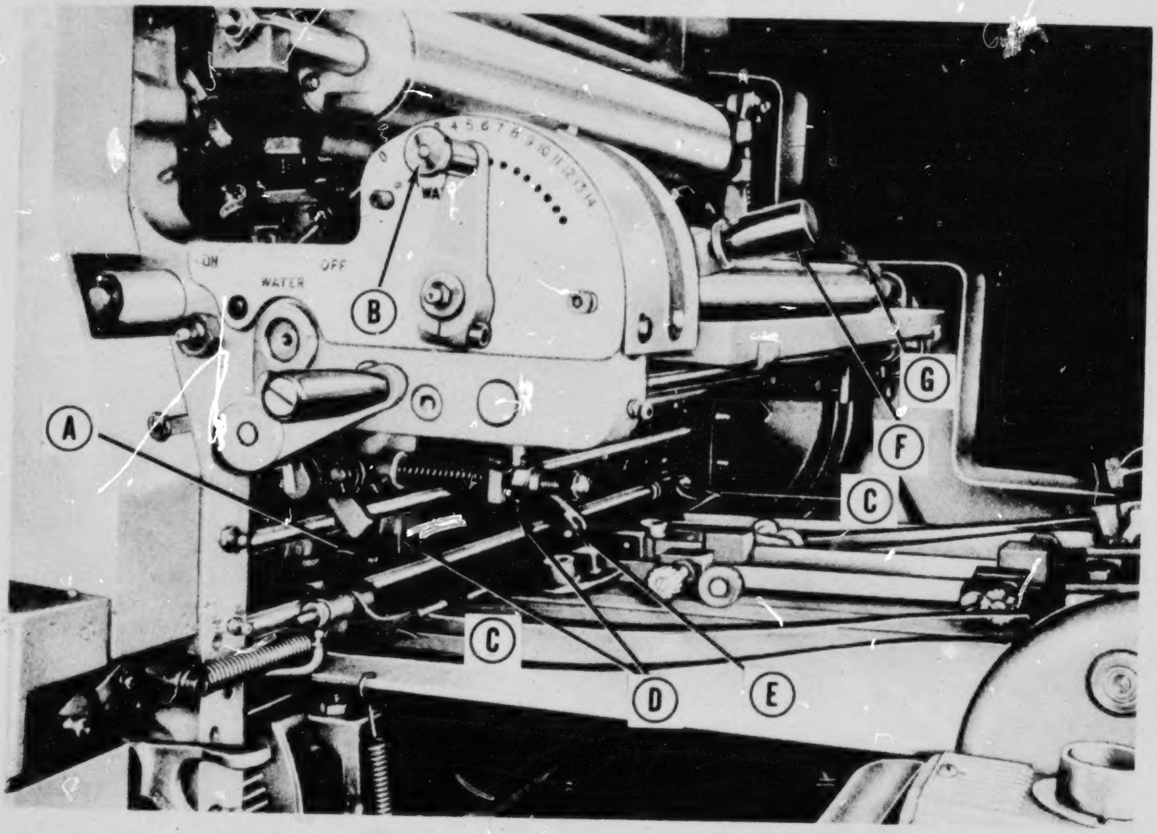
The handle (F) shown in figure 14-38 is for moving the form rollers to or away from the plate.

The lower form roller (O) shown in figure 14-45 is slightly shorter than the upper roller. To set the lower roller, pull back the retainer latch and install one end of the roller with its bearing block. Then pull back the retainer latch on the other side and latch the roller in its operating position. Insert paper feelers between the roller and the vibrator (P) and adjust the knurled head screw to provide the proper drag. Next insert feelers between the form roller and the plate cylinder and move the form roller against the plate. Loosen the jam nuts on the lower form roller socket spring rods and adjust the hex head nuts to give an even drag on the feelers; then tighten the locknuts.

Next, install the upper form roller (N) in its sockets and tighten the caps with the half-wing locknuts. Move the form rollers away from the plate and insert strips of paper between rollers (N) and (P). Adjust the knurled head screws on each of the sockets to give a light drag on the paper feelers.

After this, insert feelers between the form roller and the plate and move the rollers against the plate. Adjust the knurled head screw on each socket to push against the side frames until there is a light, even drag on the paper feelers. Then tighten the half-wing locknuts.

Finally install the ductor roller (Q) in its sockets and tighten the caps and the half-wing locknuts. Insert strips of paper between the ductor and the fountain roller. Move the press until the water ductor shaft cam roller (on the gear side of the press) is on the high part of the cam and adjust the socket head setscrew at each end of the roller to obtain a light drag on the paper feelers. Finally tighten the jam nuts on the adjusting screws.



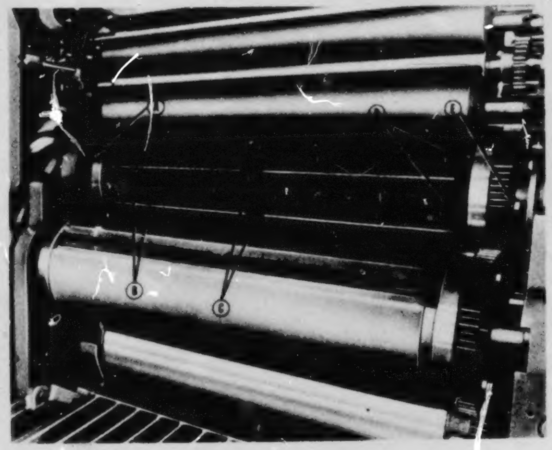
A. Front guides.
B. Water feed control. Set at 14 for maximum feed of water and at zero to cut off water supply.
C. Side guide. To change from one side guide to the other reverse the direction of the spring tension.
D. Sheet guides. Can be moved sidewise when necessary.
E. Sheet detector finger. When press is tripped, cylinders separate, feeder stops feeding, ink form rollers lift, ductor stops feeding ink, counter stops, and delivery pile stops lowering.
F. Handle for stopping motion of water fountain roller to shut off water supply.
G. Knob for turning water fountain roller manually.

57.653X

Figure 14-41.—Front and side guides.

SUMMARY OF OPERATIONS

1. Oil press at beginning of day or at beginning of each 8-hour shift.
2. Examine plate for defects; measure with micrometer to determine if underpacking is required.
3. Mount plate on cylinder. Add packing, if required.
4. Load feed table; raise stack to proper height.
5. Set feeding controls.
6. Inch sheet through press. Stop just before sheet is delivered. Set delivery.



A. Plate cylinder toggle lock. Used to hold tail-edge plate clamp forward in proper position to receive plate. After plate is tightened in this clamp, release toggle manually and tighten plate with plate tightening screws (B).
B. Plate tightening screws.
C. Eccentric clamp locks for locking plate in clamps.
D. Side adjusting screws for centering plate or moving it sidewise.
E. Bolts which lock plate cylinder to gear. Loosen when raising or lowering image on paper.

57.654X

Figure 14-42. –Plate cylinder adjustments on the Chief 20A.

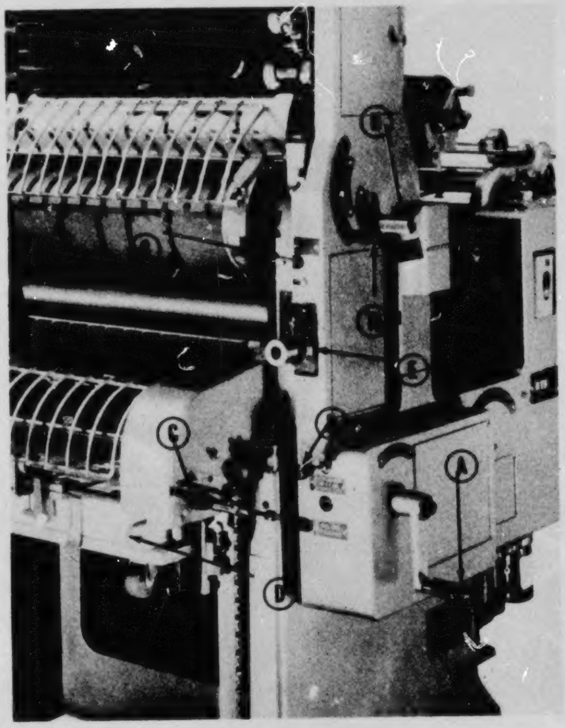
7. Put ink and water in fountains; run press to distribute.

8. Sponge plate with water.

9. Start press. Move dampening rollers to plate. After 1 or 2 revolutions, drop ink rollers.

10. Throw off rollers. Stop press and examine plate to see if all parts are inking properly.

11. Sponge plate and start press again. Move rollers against plate.

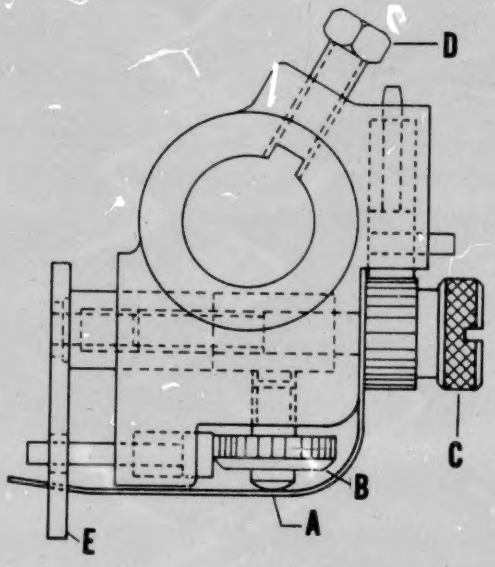


A. Handle for raising and lowering delivery platform manually.
B. Delivery pawl throw-off knob. Pull out to stop automatic lowering of delivery table to build up pile inside joggers at the beginning of a run.
C. Knob which regulates rate of descent of delivery platform. Set to adjacent scale for thickness of stock being run.
D. L-shaped rod used in setting side joggers.
E. Knob used for adjusting impression cylinder to blanket cylinder for proper printing pressure. Pressure must be adjusted for various thicknesses of stock.
F. Ink lock-up handle.
G. Impression throw-off lever. Push in to throw impression off.
H. Handle for raising and lowering ink form rollers.

57.655X

Figure 14-43.–Delivery end of press.

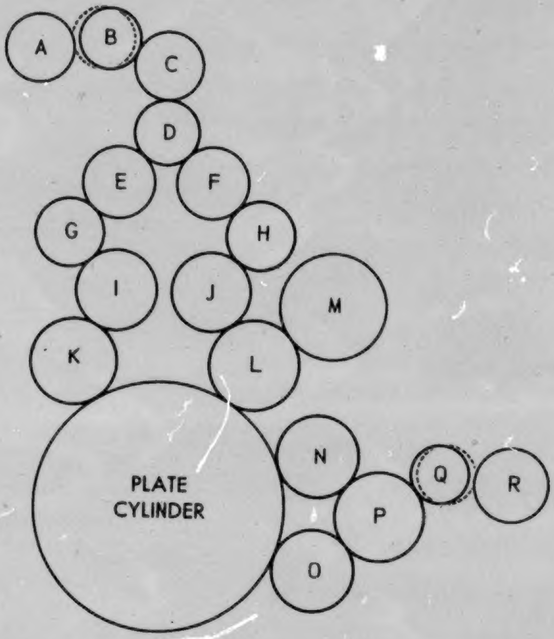
12. Start vacuum pump; push down feeder control lever to start sheets feeding and throw on impression.



- A. Spring guard which directs sheet into plate (E).
- B. Screw which regulates clearance of paper stock.
- C. Screw used in changing gripper bite. Clock wise turn produces less bite: raises image on paper.
- D. Square headed screw. Loosen when moving guide sidewise.
- E. Plate which serves as stop for sheet.

57.656X
Figure 14-44.–Front guides on the Chief 20A.

13. Shut off vacuum as first sheet leaves feedboard.
14. Stop press as soon as sheet is delivered.
15. Check sheet for position, color, and impression.
16. Gum plate and wipe dry if extended make-ready operations are to be required.
17. Make necessary adjustments to position image on sheet.
18. Adjust impression, if necessary.
19. Spot or build up low areas in blanket, if necessary.



- A. Ink fountain roller.
- B. Ductor roller.
- C. Metal rider roller.
- D. Rubber distributor roller.
- E. Metal vibrator roller.
- F. Metal vibrator roller.
- G. Rubber distributor roller.
- H. Rubber distributor roller.
- I. Metal vibrator roller.
- J. Metal vibrator roller.
- K. Rubber form roller.
- L. Rubber form roller.
- M. Auxiliary vibrator roller.
- N. Upper dampener form roller.
- O. Lower dampener form roller.
- P. Chrome dampener vibrator roller.
- Q. Dampener ductor roller.
- R. Chrome dampener fountain roller.

57.657X
Figure 14-45.–Diagram of inking and dampening rollers.

20. Adjust thumbscrews on ink fountain, as required.
21. Sponge plate. Print another trial sheet.
22. Check sheet and make further adjustments, if necessary.

23. Run waste sheets until ink and water are properly set.
24. Set counter. Start run.
25. Set lowering device for delivery platform.
26. Check sheets during run for register, and for proper balance between ink and water.
27. At end of job, remove plate and store. Prepare press for next job.
28. If job is to be backed up, allow ink to dry. Then turn stock over and follow procedure just discussed in running backup.
29. Use other side guide for back-up run.
30. At end of day or each time you change color, remove ink from fountain. Wash fountain and rollers thoroughly using washup attachment. Clean ends of rollers with a solvent-soaked rag. Wash blanket with blanket wash and water.
31. Clean dampener rollers and remove water from fountain.
32. Clean and lubricate all gears at regular intervals. Change conveyor tapes and dampener covers and make other adjustments as required.

CHAPTER 15

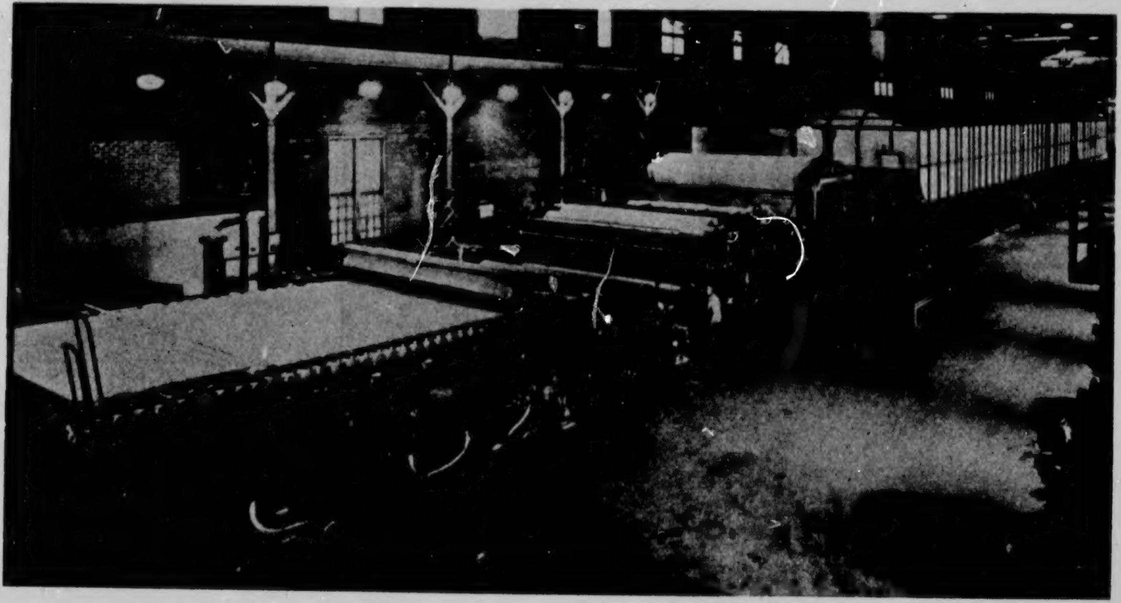
PAPER AND INK

Paper is the single largest material cost in printing. It is also the source of a majority of problems to the printer. Paper and ink together are the most influential factors that affect the visual quality of printing.

WHAT IS PAPER?

Basically, paper is a thin layer of vegetable fibers. Its appearance and usage are affected by the types of fiber used, the method of preparation, the various substances which may be added, and the finishes applied. Most papers are composed of wood fibers, although cotton, flax, hemp, bamboo, grass, and other vegetable fibers may be used. A knowledge of the ingredients and papermaking processes will give you an insight into the characteristics of paper and enable you to understand it and control it.

Essential to papermaking for this modern age is the continuous papermaking machine. A widely used machine, it is called the Fourdrinier machine, after its inventors. (See fig. 15-1.) The wood fibers, diluted to about one-half of one percent, are flowed onto an endless wire screen. The screen is agitated as it travels, causing the fibers to aline parallel to the direction of travel. As the water drains from the paper, the web (as it is called) is capable of being lifted. The web is passed under felts to remove more water, then over drying rolls to remove almost all of the



57.756X

Figure 15-1.—Modern age continuous papermaking machine.

remaining water. The paper is then treated and smoothed and wound on rolls. These master rolls are later slit and rewound on rolls or cut into sheets as required by the customer.

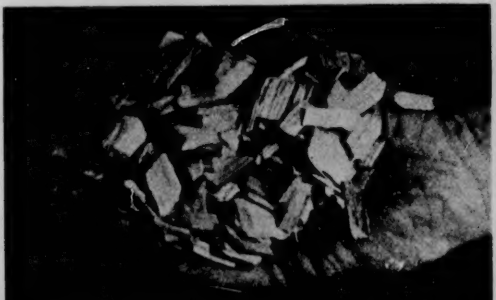
PAPERMAKING

The process of converting logs and other fibrous substances into paper begins with the manufacture of "pulp".

Pulp

There are four general classes of pulp used in papermaking. The first, mechanical (or ground) wood pulp, is the simplest and least expensive process. With the exception of the bark, whole logs (generally pine, spruce, fir, or other soft woods) are shredded and then ground into fine particles. (See fig. 15-2.) These particles are mixed with water and flowed onto the papermaking machine. An example of mechanical pulp is newsprint.

A second type of pulp is made from old paper. The quality of old paper pulp depends upon the types of waste paper used. Relatively good pulp may be obtained by using fine paper scraps which have not been printed. Poorer pulp is made from mixed, previously printed waste paper. The scrap is cooked with lye to dissolve the ink and reduce the old paper to pulp, and with bleaches to whiten the pulp. Better quality old paper pulps are similar to the paper stocks from which they were made. Poorer quality pulps are used in making boards such as those used on the back of writing tablets.



57.757X

Figure 15-2. — Wood chips are processed and diluted with water to obtain wood pulp.

A third means of obtaining paper pulp is by grinding and cooking old rags. Cotton and linen rags are the most commonly used, but rag pulp has been made from man-made fibers such as rayon and nylon and from mineral fibers such as asbestos. Unused white rags are the best for pulp as wear, laundering and dyeing weaken the fibers. Rag pulp may be used entirely (100% rag papers are the most permanent and are used in legal documents, etc.), or the rag pulp may be mixed with wood pulp (25% rag bond is generally used for Navy letterheads).

The most widely used pulping method for fine printing paper stocks is the chemical wood process, in which wood chips are cooked in various chemicals to remove unwanted gum, resins, and similar materials. As a considerable amount of these materials is removed in the process, chemical wood pulp requires almost twice the quantity of wood or mechanical pulp.

There are several classes of chemical wood pulp. They vary according to the chemicals used in processing them. Most common is the sulfite process, in which the wood chips are cooked in lime and sulphurous acid. Softwoods, such as fir and pine, are used for sulfite pulp, which is used in good grades of book and writing papers.

There is another type of pulp known as sulfite pulp. In this process, either softwoods or hardwoods, such as beech, maple, and oak, are used. The wood is cooked in caustic soda and sulfur. Sulfite pulp is used in the manufacture of kraft paper for grocery bags, and so on. Bleached sulfite pulp is also used in making other papers.

The soda pulp process uses hardwoods, which are cooked in caustic soda to remove impurities.

In addition to these processes, there are refinements of the sulfite process which produce even finer grades of paper pulp.

As each type of pulp has its own characteristics, modern papermakers combine various pulps in differing quantities to produce the great variety of papers in use today. The compounding of pulps and other ingredients and their treatment is known as "stock preparation". The stock is prepared in beaters, which consist of large tubs in which the pulp is crushed in great quantities of water by the action of rollers against a metal or stone bed-plate. This beating serves to fray the ends of the individual fibers so they will cling together. It also softens the cellulose of the fibers to cement the fibers into a solid mass. Beating is the most important step in papermaking, as the type and degree of beating determine the final character of the paper. Both blotting paper and bond paper may be made from the same pulp, depending upon the beating.

Refiners are also used to treat pulp in a manner similar to beating. Pulp refiners are large conical shells in which close-fitting, rotating plugs pulverize the fibers. These refiners are used with beaters to prepare pulp, or they can be used instead of the beaters.

Additives

Most of the papers made today require the addition of substances to the fibers to produce different papers for various purposes. These additives are grouped as follows: sizing, loaders and fillers, colorings, and special additives.

Substances added to paper to resist rapid, excessive moisture penetration are called "sizing". Rosin sizing is the most widely used. If it is added in the beater, it is called engine or beater sizing. If the web of paper is passed through a tub of sizing, it is called tub or surface sizing. Many printing papers, particularly offset papers, are both beater and surface sized. An example of unsized paper is blotting, which readily absorbs liquids. Weak-sized papers are typified by newsprint. It will accept writing ink, but the ink will spread or "feather". Bond paper is an example of hard-sized paper. It will accept writing ink without feathering.

Various mineral substances are added to pulp to give it certain characteristics. (See fig. 15-3.) These are known as loaders and fillers. Clay, calcium carbonate, talc, and titanium dioxide are used as fillers to even the paper surface and as loaders to increase opacity of the paper. Fillers or loaders may comprise 8 to 15 percent of the weight of offset papers.

Coloring materials, such as mineral pigments and organic and synthetic dyes, are used to produce a rainbow of colors in modern papers.

57.758X

Figure 15-3.—Various chemicals are added to pulp for each of the many types of papers manufactured.

Most pigments are added in the beaters; dyes are applied to the surface of the paper after it has been formed and sized in the paper machine.

Special additives are used for many different purposes. Bleaches are added to pulp to increase brightness. Vegetable starches are added as binders to smooth the surface and increase hardness. Resins may be added or the fibers may be treated with dilute sulphuric acid to increase the wet strength of map and chart papers.

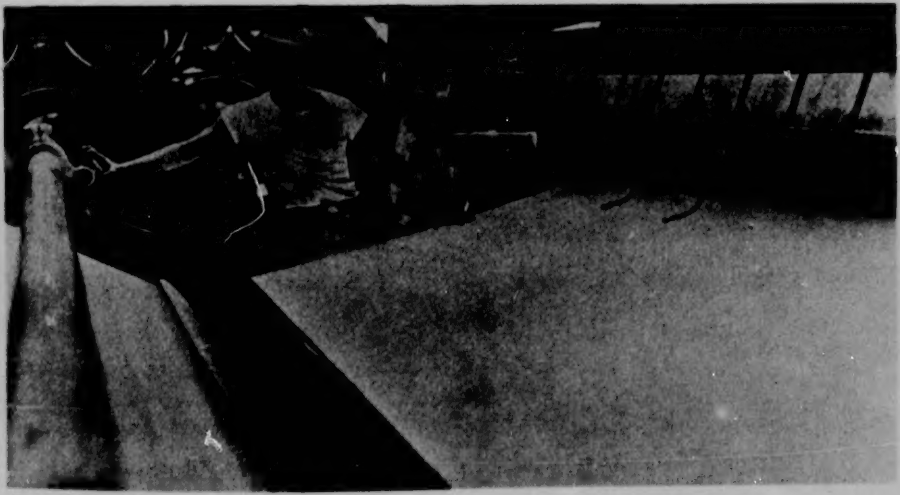
Coating

Uncoated paper consists of the stock just as it comes from the papermaking machine; coated stock is paper that has received a fine layer of mineral substances or a synthetic, plastic-like covering. Coatings may consist of clays, barium sulfate, calcium carbonate, and titanium dioxide in various combinations. They are applied by passing the web through vats, or through rollers or blades (similar to the ink fountain blade). The coating may be applied to both sides of the paper, as in the case of paper used for quality pictorial magazines, or to only one side of the paper, as in the case of paper used for labels. Coated paper presents the smoothest possible surface for printing fine halftones. The surface may be highly polished or it may be matte or semi-matte. Some paper manufacturers refer to their coated papers as "enameled" stocks, but this term has no precise technical meaning.

Finishing

The term "finish" refers to the last papermaking operation. This operation affects the appearance and the texture, or "feel", of the paper. Since a smooth surface is important in fine halftone reproduction, most full-color printing is done on coated paper which has been finished to a high polish. The smoothing is done after the web has passed through the drying drums in the paper machine. (See fig. 15-4.)

"Antique" paper is an example of stock which is used just as it comes from the paper machine. For a smoother surface, the paper is passed through a series of calender rollers on the paper machine. This stock is known as "machine finish" (MF) paper. It is possible to produce an even smoother surface by passing the paper one or more times through supercalenders. This paper is known as "supercalendered" (SC) or "super", and is one of the more frequently used printing surfaces. The calendering and supercalendering operations take place in a series of highly polished steel rollers, sometimes alternated with cotton or paper rollers, arranged in a

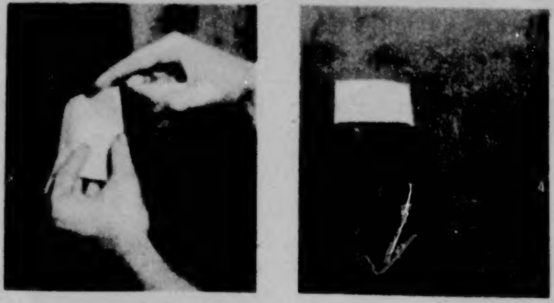


57.759X

Figure 15-4.—The paper web passes over drying rolls, is sized, coated, calendered, and wound onto huge rolls.

"stack". The paper is fed into the top and is progressively compacted and smoothed as it passed down the stack. Coated papers are also passed through the supercalender stack to smooth and polish the coating.

Special finishes are applied to the paper in a number of ways. Papers used for better stationery are often given a "laid" or "wove" finish. These patterns are impressed into the wet web on the paper machine by a "dandy roll". Evenly spaced wires across the roll produce the ladder or laid effect, while a woven screen of wires produces the wove finish. The dandy roll is also used to produce watermarks on paper, such as the familiar eagle and stars on U.S. Government rag bond papers. After the paper web has been dried, other finishes such as leather, pebble-grain, linen and so on, may be produced by passing it through a rotary embossing machine.



57.440

Figure 15-5.—Paper grain can be determined by creasing paper in both directions and running your finger along both creases to see which edge is rougher (left). The smoother edge indicates the grain direction. Another method is wet a 2" by 2" strip of paper and observe its curl (right). The strip will curl across the grain.

PAPER GRAIN AND FACE

The grain of paper refers to the position of the fibers. As you have seen, diluted pulp is flowed onto a screen in the paper machine. As the screen moves forward, it is agitated and the fibers aline in a direction parallel to the length of the machine.

Paper grain is of particular importance to you as a lithographer. First, paper is stiffer in the grain direction. This is important in the case of books and pamphlets which are to be folded. The grain direction of the stock should be parallel to the binding edge; if it is not, the pages may be difficult to turn. Second, paper changes (stretch or shrinkage), due to the humidity, are greater across the grain than with it. These changes will be discussed in detail later in this chapter. To minimize register problems due to moisture, paper is generally cut so that the grain runs across the cylinder. Third, paper is more easily torn in the grain direction than against it. (See fig. 15-5.)

Except for a few special papers, all papers have two distinct sides or "faces". As you have seen, the paper pulp is formed on a moving wire screen in the paper machine. The surface in contact with this screen is impressed with the pattern of the wire and is called the "wire side" or bottom of the sheet. The other surface is pressed against a series of felt rollers in removing water and is known as the "felt side" or top of the sheet. In the paper machine, there is a tendency for finer fibers and filler materials to float on the surface of the diluted pulp. Therefore, the felt side is a better printing surface, and the printing should be done on this side if there is a choice (letterheads, for example). Many fine commercial papers are marked or tagged to show the felt side. In the case of watermarked papers, the watermark reads properly (left to right) when viewed from the felt side. (On U.S. Government watermarked papers, the eagle faces to the left when viewed from the felt side.)

Although calendering removes most of the wire marks, you can determine the "faces" of an uncoated sheet by observing the surface with the light striking it at a 45° angle. The typical screen pattern may then be seen. Sometimes it may be necessary to dampen the sheet on both sides to swell the fibers, making the pattern more discernable.

BASIC SIZE AND BASIS WEIGHT

Size and weight in relation to printing papers are the basis of much confusion. Paper is used by area (8″ X 10-1/2″ on the job order, for instance), but bought at the mill by weight (cost being determined by weight more than other factors). For you to make calculations regarding paper, two kinds of data are necessary. You must know the "basic size" and "basis weight".

Basic size refers to the established standard size for a stock sheet of a specific type of paper. The basic sizes are related to the uses of the different papers and the presses on which the different products are printed. For instance, the basic size for business papers such as bond and other types of writing paper is 17″ X 22″. As you know, most commercial stationery is 8 1/2″ X 11″, and this can be cut four-out of a 17″ X 22″ sheet. Therefore, 17″ X 22″ is used as the basic size for all business papers. Publications work is generally run on 38-inch presses, so 25″ X 38″ is the accepted basic size for book papers. Basic sizes for various papers are given in figure 15-6.

Kind of paper	Basic size (inches)	Area (square inches)
Business papers (bond, ledger, manifold, mimeo, writing, map)	17 x 22	374
Blotting	19 x 24	456
Cover	20 x 26	520
Bristols, postcard, tag and blanks	22 1/2 x 28 1/2	641 *
Index	25 1/2 x 30 1/2	778 *
Newsprint, tissues, wrapping	24 x 36	864
Book papers (including offset and coated)	25 x 38	950

*rounded to nearest whole number

57.439

Figure 15-6.—Basic sizes of papers.

Basis weight is the second factor to consider in working with paper. It is the weight of a quantity of paper of the basic size. The quantity is generally a ream (500 sheets), but at the Government Printing Office (GPO) and in many commercial firms, the double ream, or 1000 sheets, is used in determining basis weight. To avoid confusion, when designating paper, the quantity is sometimes listed after the basic size. For example, the paper on which this book is printed would be listed as: Paper, Offset Book, White, 100 pounds (basis 25″ X 38″/M) or 50 pounds (basis 25″ X 38″/500). Note that both designations apply to the same paper. Basis weights of business papers (as shown in figure 15-6 are also known as "substance" (sub.).

Equivalent Weight

Knowing which weights of book paper, for instance, are comparable (or equivalent) to bond, cover, index, and so on, can be useful to you. If it becomes necessary to substitute papers, you will have to compute "equivalent weight", using the following formula:

$$\frac{\text{basis weight} \times \text{new size}}{\text{basic size}} = \text{equivalent weight}$$

As an example, let us determine the equivalent weight of a ream of 50-pound book paper, basis 25″ X 38″/500, cut to 17″ X 22″. Substituting, in the formula:

$$\frac{50 \times 17 \times 22}{25 \times 38} = ?$$

Cancelling, you get:

$$\frac{\overset{2}{\cancel{50}} \times 17 \times \overset{11}{\cancel{22}}}{\underset{1}{\cancel{25}} \times \underset{19}{\cancel{38}}} = \frac{2 \times 17 \times 11}{1 \times 19} = \frac{374}{19} = 19.6$$

Thus, a ream of 17″ X 22″ book paper weighs 19.6 pounds, although it is still called a 50-pound stock.

Figure 15-6 lists the basic sizes of various types of paper. To compare the weight of one type of paper with that of another having a different basic size, the same type of computation is necessary. For easy reference, you may use the table in figure 15-7 for this purpose. This table provides a comparison of standard paper sizes and weights. For example, 24-pound bond is the equivalent of 33-pound cover, 50-pound index, 56-pound news, or 61-pound book.

TABLE OF EQUIVALENT WEIGHTS

Type of Paper (Basic Sizes)	Equivalent Weight of Indicated Paper (500 sheets)				
	Business	Cover	Index	News	Book
Business (Bond, ledger, manifold, mimeo, writing) (17 x 22)	13	18	27	30	33
	16	22	33	37	41
	20	28	42	46	51
	24	33	50	56	61
	28	39	58	64	71
	32	45	67	74	81
	36	50	75	83	91
	40	56	83	93	102
Cover (20 x 26)	29	40	60	66	73
	36	50	75	82	91
	43	60	90	100	110
	47	65	97	108	119
	58	80	120	134	146
	65	90	135	149	164
	72	100	150	166	183
Index (25 1/2 x 30 1/2)	43	60	90	100	110
	53	74	110	122	135
	67	93	140	156	170
	82	114	170	189	208
Newsprint, tissue, wrapping (24 x 36)	13	18	27	30	33
	14	19	29	32	35
Book (including coated and offset) (25 x 38)	12	16	25	27	30
	16	22	33	36	40
	18	25	37	41	45
	20	27	41	45	50
	24	33	49	55	60
	28	38	57	64	70
	31	44	65	73	80
	35	49	74	82	90
	39	55	82	91	100
	47	66	98	109	120

Basis weights are shown in columns enclosed by vertical rules

*Tissues determined on basis of 480-sheet ream

57.659

Figure 15-7.—Equivalent weights.

Bulk and Caliper

The "bulk" of a paper stock is a term relating to the thickness of the paper. It should not be confused with the basis weight. Papers are said to "bulk at 320 to the inch", for instance, indicating that a stack 320 sheets high would measure one inch. Bulk is a function of the papermaking machine. Some book papers, for example, are made in 60-pound basis weights and bulk at from 320 to 720 to the inch. The one which bulks at 320 to the inch is said to be "high bulk" paper as opposed to that which bulks 720 to the inch.

Thickness of paper is called "caliper" and is expressed in thousandths of an inch. Knowledge of the caliper of the paper in your shop can be useful to you, particularly if you need to underpack the press plate or blanket. Larger shops often have paper micrometers, but a machinist's micrometer may be used in determining paper caliper. The paper should be "miked" at several places to obtain an average reading.

Cardboard was traditionally measured by the number of plies, or layers of paper, used in its manufacture, such as 4-ply, 8-ply, 14-ply, and so on. Most of the paperboard today is measured in thousandths, the same as other papers. You may find, however, that some boards are still marked in plies. To convert to approximate caliper, multiply the number of plies by three and add six. For example, 8-ply board measures approximately .030 inches. The caliper of some representative papers is given in figure 15-8. Cardboards are sometimes referred to by "points", which is derived from the caliper: .030" board would be called 30 point board.

KINDS OF PAPER

There are three divisions of paper stock used in the printing industry. These are (1) commercial and book papers; (2) newspapers; and (3) packaging papers and boards. Of these three, you will be most concerned with the first; but all three divisions may use one or more of the papers typical of the others.

APPROXIMATE MICROMETER READINGS

Type of Paper	Basis Weight *	Caliper **
Bond, 25% rag	16	.0025
	20	.0033
Writing, Chemical	16	.0032
Wood	20	.0038
Ledger	24	.0042
	32	.0054
	44	.0072
Mimeo	20	.0050
Manifold, 25% rag and Chemical Wood	9	.0018
Map, 50% rag	24	.0030
Cover, Antique	50	.0070
Coated	60	.0060
Antique Laid	65	.0100
Index, Chemical	110	.0085
Wood	140	.0105
Newsprint	32	.0035
Book, English Finish	45	.0025
Antique, 50% rag	40	.0035
	45	.0038
	50	.0043
	60	.0050
Offset	40	.0027
	50	.0037
	60	.0042
	80	.0065
Offset, Opacified	60	.0045
Offset, Coated	50	.0025
	60	.0030
	70	.0033

* pounds per ream of 500 sheets
** inches

57.660

Figure 15-8.—Paper caliper.

Book Papers

Papers are usually named for the purpose for which they were originally made. This is the case with book paper, the largest class of printing papers. Book papers are made in a great variety of finishes, colors, and basis weights. Their basic size is 25″ X 38″; commonly used basis weights are shown in figure 15-8. Machine finish (MF) is the most inexpensive of the book papers. It is made from chemical wood pulp and contains little filler or sizing. Machine finish paper is suitable only for letterpress work and will take only coarse-screen halftones and line cuts.

Antique is a frequently used, bulky paper. It is a soft, uncoated paper which folds well, and is widely used for magazines and books consisting of text and line illustrations. Most antiques are not sized for offset printing, nor do they accept letterpress halftones well.

Supercalendered (SC) and Sized and Supercalendered (S&SC) papers are given a smoother surface during manufacture. This smoother surface is better for reproduction of fine halftones by letterpress than MF stock. Some "supers" are sized for use in offset printing.

Offset book papers are those which have received special sizing to prevent rapid absorption of moisture during the press run. The term "offset book" paper is generally accepted to mean an uncoated, wove finish paper. Offset papers may be run on letterpress equipment, but not all letterpress papers may be printed by the offset process. This is due to the lack of sizing in letterpress papers.

Coated papers are the "elite" of the book papers. The base stock is most often tub-sized, then surface-sized, dried and supercalendered. The coatings are then applied to one or both sides, and the stock is then supercalendered again to provide a very smooth surface.

Coated papers may be finished to a high gloss or they may have a matte or semi-matte finish as required. Although all coated papers are sized, the soluble binders used with some coatings make them unsuitable for offset printing. Most letterpress reproduction proofs (repros) are pulled on coated stock.

NOTE

It is not possible to list all the papers available on the commercial market. This chapter is intended to give you an idea of the principal types of stock and their uses. As a Navy Lithographer, you will be concerned chiefly with the stocks listed in the *Federal Supply Catalog.* The FSC (Group 93) shows the using service (Army, Navy, Air Force, Marine Corps), the basis weight or substance, basic size, colors, and other pertinent information for each type of stock available. A copy of the FSC sections pertaining to papers is available to you through your ship's supply office.

Paper stowage and requisitioning methods may differ from ship to ship. However, you should keep two things in mind when requisitioning stock: size limitation of your paper cutter and limitations imposed by stowage.

Business Papers

The broad classification "business papers" covers those which are used for stationery items and business forms, rather than publications work or promotional or advertising printing. The basic size for all such papers is 17″ X 22″.

The paper of this class which you will use most often is called "bond". The name refers to its original purpose, that of printing such legal documents as bonds and stock certificates. Some bond papers are made from chemical wood pulp; the better grades contain rag fibers. All bond papers are sized to accept writing inks without feathering; some receive special coatings to make erasures easy. Business forms are usually printed on sulfite bond papers.

A heavier paper with similar characteristics is known as "ledger". It was originally designed for the printing of accounting records. In addition to ready acceptance of inks and long life, ledger has extremely good folding endurance, which means it may be repeatedly folded without cracking or tearing along the fold. Ledger also has good erasure tolerance.

At the other end of the scale, lighter-than-bond papers are known as "manifold". These lightweight papers are used in typing carbon copies. Rag content manifold papers are often referred to as "onionskin" from their texture, and are often used as airmail stationery.

A specially sized, soft-textured paper is required for stencil process (mimeograph) duplicating. This is known as "mimeo". Some mimeo stock contains rag fibers, but most is made of chemical wood pulp. For hectograph processes (such as Ditto), a differently sized, smooth-surface paper, known as "duplicator", is used. Neither of these stocks is particularly suited for offset printing.

Another specially treated business paper is used for checks, receipts, and similar documents which must be protected against alteration. Such papers are called "safety papers". They usually have watermarks consisting of geometric designs or similar protective devices.

Although not technically a business paper, there is another paper with a basic size of 17" X 22". This is known as "map stock" or "wet strength stock". Map papers are used for charts and maps which are subject to hard usage and exposure to the elements. They must accept inks with a minimum of penetration, must have good opacity, and must have good folding qualities. Made of bleached sulfite pulp, with up to 50% rag fiber content, the paper is hard-sized, then treated with resins. These resins bind the fibers together with an almost insoluble bond. Special provisions must be made for destruction of classified matter printed on map stock, as it cannot be pulped.

Carbonless Papers

Within recent years, paper engineers and chemists have developed specially coated business papers which eliminate the necessity of using carbon paper in making duplicate copies. These papers are coated with certain chemicals which react under contact and pressure of a pen, pencil or typewriter key, to produce a duplicate image on successive sheets. As many as fifteen legible copies may be made with an electric typewriter using some of these papers, but the normal quantity is eight or nine.

To effect the image transfer, chemicals from the back of one sheet combine with chemicals on the front of the next. Top sheets (originals) are coated on the back only (CB), and the bottom sheets need to be coated on the front only (CF), while intermediate sheets need coating on both front and back (CFB). CFB is considered an all-purpose stock, and can be used in most cases where carbonless paper is required.

Carbonless papers are not compatible with one another, so they cannot be used interchangeably. Another word of caution: the system will not work if the printing is on the wrong side. Determine the proper surface before printing. Generally, the coated side of carbonless paper has a gritty feel to it, while the uncoated side is smoother. A test may be made by placing two sheets together and marking the top. If the mark is transferred to the bottom sheet, the proper printing surface is on top.

Several points should be observed when you are working with carbonless papers that will help to eliminate many of the problems that can occur in the pressroom. Some of the problems can be eliminated before they occur by allowing the paper to condition itself in the pressroom area. This conditioning period permits the paper to adjust to the humidity and temperature of the pressroom gradually, thereby reducing the possibility of the sheets curling or wrinkling as they are run through the press. (This is true of all papers, but is most important when the paper is carbonless.)

The pressure setting between the blanket cylinder and the impression cylinder must be adjusted to a minimum that will produce an even impression on the sheet without "toning" it. Additionally, you should check the sheets for pressure marks from the press forwarding rollers, caliper, sheet hold-downs, grippers, and ejector wheels.

When you are cutting carbonless papers, place scrap pieces of chipboard or index paper on the top and bottom of the paper lift to eliminate pressure marks from the paper clamp. Also use a minimum amount of clamp pressure.

Bristols and Cards

Bristols are lightweight cardboards, and are of three types: (1) index; (2) mill bristol; and (3) wedding bristol. Index is a heavyweight writing paper, sized to accept writing inks and permit easy erasure. The basic size of index is 25 1/2" X 30 1/2". Mill bristols are made for advertising materials, such as Navy recruiting window cards, which require a stiff sheet with a good printing surface. Wedding bristol is made of plies of white boards, with a surface which will accept writing inks, and is used for invitations and other social items. Basic size for mill and wedding bristols is 22 1/2" X 28 1/2".

Another card stock you should be familiar with is called "postcard". Postcard stock is made in two types, coated and uncoated. The coated postcard is coated on one side, for the printing of such items as souvenir postcards, and the other side is sized to accept writing inks. Uncoated postcard is similar to mill bristol, but has been sized for writing inks. The most common example is the 8¢ postal card. Basic size for postcard is 22 1/2" X 28 1/2".

Tagboard is another lightweight cardboard, most often made of sulphate pulp and hard-sized and supercalendered. It is an especially tough board, made for rough use such as baggage tags, and so on. Since the use of computing machines has become so widespread, special papers have been developed for the punched cards used in these computer systems. Tagboard, made to close tolerances, with extra resistance to curl and of exceptional dimensional stability, is used for these cards. It is known as "tabulating board". The basic size for all tagboards is 22 1/2" X 28 1/2".

Covers

Using a strong, serviceable cover on a publication prolongs its useful life. A broad range of cover papers is available. They come in a great variety of colors, bold and pastel; with embossed or plain finishes; coated and uncoated; gloss or matte; and some even have one color on the front and a different color on the back. In the Navy, you will use only a small number of colors and your stock will usually be antique finish.

Cover papers may be used for purposes other than book covers. Programs and menus are two applications to which cover papers are especially suited. You will find that printing with a darker ink of the same color as a pastel cover produces an interesting effect, and a dark, complementary color printed on a pastel cover stock will give a pleasing two-color effect.

There are instances where exceptionally hard use will be given to a publication; a telephone book, for instance. In this case, it may be advisable to use an index or tagboard cover.

The basic size for all cover papers is 20" X 26".

Miscellaneous Papers

Included in this section are those papers which you will use infrequently, if at all. A general knowledge of them will be helpful to you, however.

Newsprint is used in enormous quantities by the daily and weekly newspapers. It requires characteristics not needed by other classes of paper; it must be as inexpensive as possible, it need not be permanent, and it must have a high absorbency.

To be inexpensive, it must be made of ground wood pulp. As newsprint does not need permanence ("Nothing is as old as yesterday's news", goes the saying), the pulp is very lightly beaten. The inks used in newspaper printing are fluid and dry by absorption, so the pulp contains little or no sizing. Some smaller newspapers are now being printed by web offset, so offset-sized papers are made for them. It is possible to produce colored newsprint by adding pigments to the pulp. This is known as "poster stock". The basic size for newsprint is 24" X 36". Almost all newsprint is made in basis weight of 32 pounds, although it can be obtained in weights from 30 to 35 pounds (basis 24" X 36"/500).

Blotting papers are not used as frequently as they once were, as we do most of our writing with ball-point pens. Blottings are loosely beaten, unsized, soft-finished papers with a natural affinity for water. Some blotting papers are coated on one side for use as advertising pieces. The basic size is 19" X 24", and basis weights range from 80 pounds to 240 pounds (basis 19" X 24"/500).

The packaging industry uses a variety of papers and boards. Label papers are one of these types. Many are coated on one side to provide a smooth printing surface, and unfinished on the other, to provide a good "tooth" for glues and cements used in packaging. Special sizing is used to prevent the adhesive from soaking into the paper. The basic size is 20" X 25".

Heavyweight boards are called, variously, "mill blanks", "coated blanks", and "railroad board". All are made by pasting layers of finished stock to a base stock similar to chipboard. Blanks are made in thicknesses from .012" to .078" (12 to 78 points), and are used primarily in the packaging industry. You may have need for heavy duty signs and will be asked to print on blanks. A word of caution: Presses using cylinders (all offset presses, and flatbed letterpresses) are not suitable for printing stock heavier than .030" (sometimes called 8-ply). A platen press is the only means of printing on these heavier stocks. The basic size for blanks is 22 1/2" X 28 1/2".

Tissue is a thin, lightweight paper, most often used to describe light wrapping papers as distinguished from facial and other soft tissue papers. Most tissue papers are made of chemical wood pulp, sized and machine finished. Basic size is 24" X 36", and tissues range in weight from 12 to 18 pounds, but basis weights are determined with a 480-sheet ream. This is because tissues are traditionally sold at retail in quires (24 sheets). Tissues form the base for many carbon papers. These are usually rag content tissue papers, specially sized and glazed.

Wrapping papers are another group of miscellaneous paper which you may use. The most commonly used is that made of strong sulfite pulp, called kraft paper. Kraft wrapping is usually brown in color and sold in rolls for use in wrapping packages.

Although kraft wrapping is made in basis weights of from 18 to 250 pounds (24" X 36"/500), it is generally used in weights of 25 to 80 pounds. In addition to kraft wrappings, other wrapping papers, such as decorative or gift wrappings, are manufactured. Basic size for all wrappings is 24" X 36". A special type of sulphate wrapping, sometimes containing jute fiber pulp, is used as a draw sheet, or tympan, on platen or cylinder letter presses. This paper is made of well beaten pulp, hard-sized, and is calendered to a precision caliper. Tympan paper is manufactured in thicknesses ranging from .003" to .012", with .006" most generally used. It is sold in rolls or custom-cut for specific presses. Some tympans are oil-treated.

RECYCLED PAPER

In recent years, there has been greater emphasis than ever before in ecology and man's efficient use of raw materials in products. The papermaking and printing industries, in cooperation with government agencies, have spent considerable time and money in research into this problem.

The use of waste materials in the manufacture of papers is not new. As you have seen earlier in this chapter, old paper and rags are processed to obtain pulp which is used in the papermaking process.

The two most obvious advantages of using waste materials in the papermaking process are a reduction in the amount of virgin timber required and a lesser amount of waste disposal. Problems associated with recycled paper usage are increased production costs by the paper mill and a reluctance by the printing trade and it's customers to use a product thought by many to be inferior to "new" paper.

Tests have shown that the printability of recycled paper is superior in many ways to paper that does not contain recycled materials. The fibers in recycled paper tend to allow the sheets to lie flatter and increase the paper's opacity.

You can expect the trend towards the use of recycled papers to increase in the future. It is estimated that of a total paper consumption of 100 million tons annually in the 1980s, recycled papers will comprise one-third of that total.

Envelopes

An envelope is essentially a container. Its purpose is to protect its contents during transit or storage. Envelopes are made in a great variety of sizes and shapes, with papers of almost every conceivable type.

Envelopes are made of sulfite and rag content papers to match letterhead stationery. They are made of rag content stock or the cheaper grades of sulfite or sulfate papers, usually with a wove finish, for general mailing. They may be made of lightweight cover papers for advertising mail, and are made of lightweight rag and sulphite stock for airmail.

For heavier usage, envelopes are made of kraft and manila sulphate stocks. Kraft stocks are brown; manila papers are tan or cream colored. Still stronger envelopes are made of lightweight tagboard or ledger papers.

Illustrations of commonly used envelopes and their sizes are shown in figure 15-9.

The U.S. Postal Service has established certain standards for envelopes handled in the postal system. They must be generally rectangular in shape and a minimum of 3" X 4 1/2" in size.

Printing of large quantities of envelopes is often done in the course of manufacture. You may be required to print envelopes in your shop, either on letterpress equipment or on small offset presses. Because of the varying layers of paper in envelopes, special press makeready is often necessary.

CARING FOR PAPER

As you have seen, paper is composed of fibers that are easily affected by moisture. Because of this, paper is dimensionally unstable. A sheet of paper will gain moisture and expand in a moist atmosphere; or, it will lose moisture and shrink in a dry atmosphere. When paper is piled, the changes affect the edges of the sheets first and most noticeably. Dry paper in a humid area absorbs moisture along the exposed edges, expands, and develops wavy edges, particularly across the grain. Paper that has a high moisture content, when left in a dry atmosphere, loses moisture, shrinks, and develops tight edges. These changes are also more severe across the grain. This is because the paper fibers expand and contract more readily in their diameter than in their length. Figure 15-10 shows these various conditions.

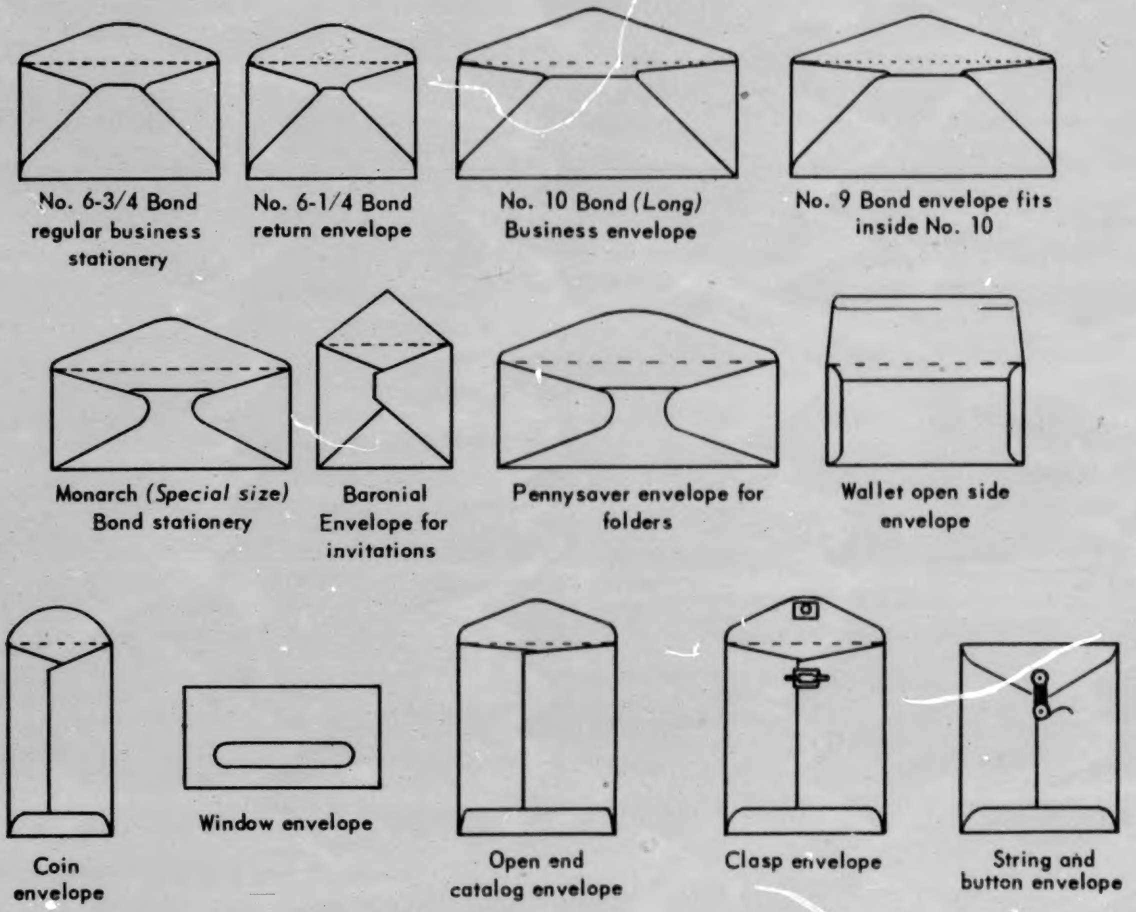
Whether the problem is a wavy edge or a tight edge, paper that has been altered by moisture will no longer be flat. When such a sheet is subjected to the continuous, equalized squeeze of offset printing, distortion, misregister, and wrinkling are likely to occur.

When paper is brought into the pressroom from storage areas, it should remain in its sealed wrappers until it has reached stability with the shop atmosphere. This is particularly important when the difference is pronounced, such as would be the case if the paper were just brought up from a GSK storeroom below the waterline to a warm shop on the 01 level. The ideal condition for the paper for offset printing is to have a moisture content at or slightly above that of the pressroom. Allowing the paper to remain in its sealed packages until moisture balance is reached is called "seasoning" or "conditioning". Seasoning is the most effective preventive for paper problems.

You saw earlier that moisture changes are less pronounced with the grain than against it. For this reason, paper is usually cut so that the grain is across the cylinder rather than around it. In most cases, this means that the paper is cut "grain long". On small duplicator type presses, however, short grain paper is better. This may result in an uneconomical cut from mill sheets, but the circumstances may warrant this seeming waste.

Changes in sheet size caused by moisture on the press are most often unimportant. However, in the case of multicolor runs (charts for an amphibious landing, for example), dimensional changes can present serious register problems. Too often, the misregister is not noticed until the second or subsequent color is run. It is then too late to remedy. Reduced packing under the plate and increased blanket packing may compensate for paper stretch; while a reversal of this procedure may compensate for shrinkage of the sheet. Reducing the blanket packing along the side edges may be helpful when running wavy edged paper. Minimum impression cylinder pressure may also help.

Excess press moisture sometimes creates a problem when you are running large solids on lightweight papers. Moisture on the upper surface of the paper will cause swelling of the fibers, resulting in a downward curl of the sheet. As the moisture is absorbed or evaporated, it causes shrinkage of the upper surface, this time resulting in an upward curl. Minimum press moisture is especially important in these cases.



No. 6-3/4 Bond regular business stationery

No. 6-1/4 Bond return envelope

No. 10 Bond *(Long)* Business envelope

No. 9 Bond envelope fits inside No. 10

Monarch *(Special size)* Bond stationery

Baronial Envelope for invitations

Pennysaver envelope for folders

Wallet open side envelope

Coin envelope

Window envelope

Open end catalog envelope

Clasp envelope

String and button envelope

COMMERCIAL ENVELOPES

NUMBER	SIZE *(inches)*
6-1/4	3-1/2 x 6
6-3/4	3-5/8 x 6-1/2
9	3-7/8 x 8-7/8
10	4-1/8 x 9-1/2
Monarch	3-7/8 x 7-1/2

(for 7-1/4 x 10-1/2 inch social stationery)

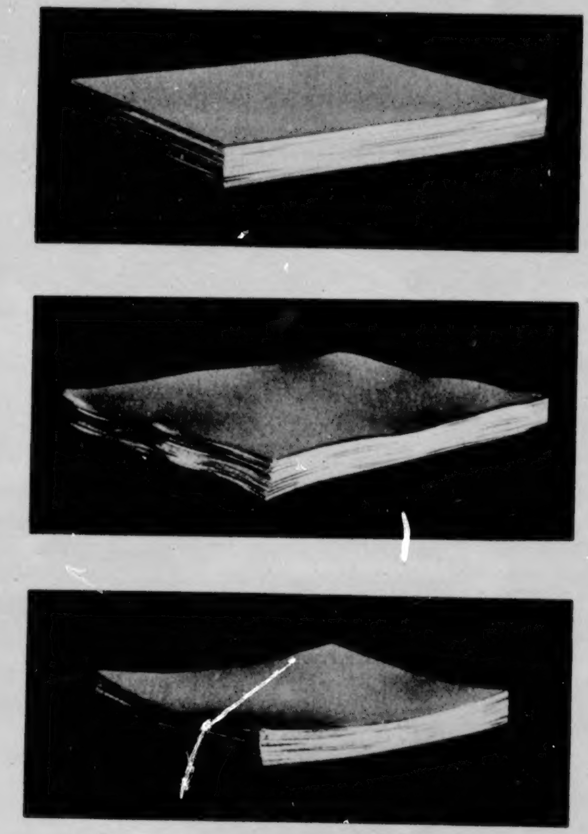
BARONIAL *(announcement)* **ENVELOPES**

NUMBER	SIZE *(inches)*	CARD SIZE
4	3-5/8 x 4-11/16	3-1/2 x 4-9/16
5	4-1/8 x 5-1/8	4 x 5
5-1/2	4-3/8 x 5-5/8	4-1/4 x 5-1/2
6	5 x 6	4-3/4 x 5-3/4

KRAFT AND MANILA ENVELOPES are designated by size and opening, with indications as to gumming. An envelope with an end opening (OE) are sometimes referred to as catalog envelopes; a side opening (OS) envelope is also known as a booklet envelope. Commonly used sizes of open end *(gummed)* envelopes range from 2-1/4" x 3-1/2" to 3-3/4" x 5-7/8"; and *(gummed)* open side envelopes range from 3-7/8" x 7-1/2" to to 14-1/2" x 18".

57.438

Figure 15-9.—Envelopes.



57.441X
Figure 15-10.—Flat paper, wavy-edged paper, and tight-edged paper.

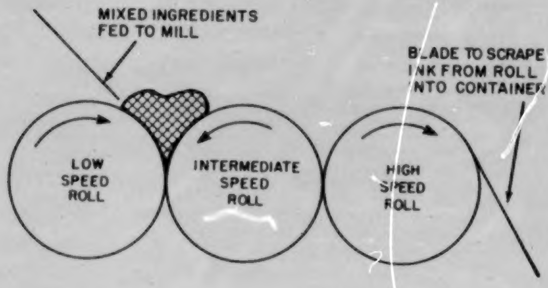
Static

Rubbing two unlike surfaces together generates static electricity. Running your comb through your hair will create such a charge and you may have noticed how small pieces of paper will cling to the comb. A similar condition exists when paper passes through the press. If the proper humidity balance has been attained, the moisture in the paper will act as a ground and dissipate the electrical charge. If the moisture content of the paper is low (and this is often the case in cold weather), static may cause the paper to cling to the blanket or impression cylinder of the press. Sheets charged with static electricity may cling together, causing the ink to offset.

Static eliminators are attached to many larger presses, and tinsel is often used on duplicator type presses for this purpose. The most effective means of static control is proper moisture balance.

INK

All printing inks consist of pigments or coloring matter; vehicles which carry the pigment; and additives which modify the other two. These materials are blended together in varying amounts to produce the many types of ink required for today's printing industry. The ingredients are first mixed, then milled in an "ink mill", as shown in figure 15-11. The ink is then packaged in drums, or the familiar 1- and 5-pound cans, or in tubes or cartridges.



57.661
Figure 15-11.—Schematic diagram of a three-roller ink mill. As the rollers turn, the pigment is evenly dispersed in the vehicle. The particles of pigment must be small enough to permit even coverage by the vehicle. The ink cannot have a gritty consistency, or damage to the plates could result.

Vehicles

The vehicle must be fluid on the press and must dry almost instantly when transferred to the paper. It must hold the pigment and it must adhere to the paper or other stock. It provides the gloss or other finish of the printed page and it influences the wearing qualities of the printed image. In addition to flowing properly on the press, it must protect the pigment from the action of the acids in the fountain solution.

Lithographic varnish is the most commonly used vehicle. It is composed largely of boiled linseed oil. Linseed oil is derived from flax seeds. After being purified, the oil is "cooked" under pressure at varying temperatures and for varying lengths of time, depending on the consistency desired. Varnish viscosity is indicated by numbers ranging from 00000 to 9. No. 00000 is the least viscous, being just a little thicker than water, while No. 9 is the heaviest, being similar in viscosity to shortening or lard. The Nos. 00000 to 0 varnishes tend to thin the ink and the No. 1 to 9 varnishes tend to thicken it. The two heaviest varnishes, Nos. 8 and 9, are sometimes referred to as "body gum".

In addition to flax seeds, vehicles for printing inks may be made of other vegetable oils, such as tung (also called China wood oil), and soybeans. Some types of fish oils are also used to make varnishes.

Sometimes vehicles are made of combinations of oils and resins. Either or both the oil and the resin may be natural or synthetic. The heat-set inks are an example of resinous-vehicle inks. Mineral oils are sometimes used as the vehicles for newspaper inks, and other specialized vehicles are used in other phases of the printing industry.

Pigments

The coloring matter of ink is provided by a substance known as the "pigment". There are two broad classifications of pigments: inorganic or mineral pigments (mostly metallic); and organic or synthetic pigments (mostly derived from petroleum or coal tars). In addition to providing color, pigments impart other characteristics to the ink, such as relative opacity or transparency, light-fastness, and weather resistance.

Black pigments are used in the greatest quantity. The most common of these is carbon black, which is made by partial combustion of natural gas. Other black pigments are made by burning oils (called lamp black), grape husks and vines (called vegetable black), and animal bones (called bone or ivory black). Pigment made of black iron oxide is used for printing of bank checks which are processed electronically. The iron particles are magnetized during the processing. Most black pigments have a blue undertone, but certain vegetable blacks have a red undertone. The term "undertone" and its companion "masstone" are discussed later in this chapter.

White pigments also have wide usage. The most common of these is titanium dioxide. It is made from a natural ore, ilmenite, which is, ironically, jet black. White pigments which are transparent are sometimes called "extenders". Among the most common are alumina hydrate, blanc fixe, and gloss white, which is a chemical combination of the other two. White pigments serve to reduce highly concentrated organic pigments and improve their working qualities. Alumina hydrage, used alone, has a tendency to cause "livering", which is discussed later in this chapter.

The rainbow of colors used in printing inks is produced by a variety of pigments, ranging from simple mineral salts to complex synthetic dyestuffs. Some are relatively opaque, while others are almost transparent.

Additives

Substances used to modify the vehicle or pigments are called "additives" and are used in very small proportions. Included in this group are such materials as metallic driers, waxes, anti-skinning agents, and retarders—even perfumes.

The most important of the additives is drier. Driers are metallic compounds which act as catalysts. That is, they promote or accelerate the natural drying of the vehicle without themselves being changed. Metals such as cobalt, lead, and manganese are the most commonly used. Cobalt (or liquid) driers are the most effective, but they have limitations. They dry from the top down, and form a film which will not "trap" or accept successive inks in multicolor work. A combination of lead or manganese with cobalt in paste driers is used where drying from the paper up is required.

Driers are added to inks in small amounts, a little at a time. The rule of thumb is 1 ounce to 1 pound, but up to 1 1/2 ounces may be added if required. Larger quantities of drier do not cause faster drying; in fact, they may even retard it. This is especially so in the case of liquid driers. Less drier is used in colored inks than in black.

Waxes of various types are sometimes added to provide a special surface to the dried ink. Anti-skinning agents and retarders are used to prevent drying of the ink in the fountain or on the press rollers. Perfumes are used to cover odors in the ink which might be objectionable, or to give a scent to inks compounded for advertising materials.

Properties of Inks

The physical properties of inks are almost entirely those inherent in the vehicle. As you have seen, lithographic varnishes are linseed oils which have been cooked until they reach the proper consistency. Those cooked for a short period are light and syrupy; those which have been cooked longer and at higher temperature are heavy.

Body

The property of the ink relative to its consistency is known as "body". An ink with a heavy body is called "short" or "stiff". Its consistency is much like shortening or water-pump grease. A small amount placed between the tumb and forefinger will break readily when the fingers are separated. As the body of the ink becomes thinner, it becomes "long" or "soft". Its consistency is like molasses or motor oil. Most ink is of the proper consistency just as it comes from the can. It should not, however, be taken directly from the can and placed in the ink fountain. Most lithographic inks are "thixotropic"; that is, their consistency changes depending upon their state. When in the can, they are rather short, but as they are stirred, they become longer. Before adding varnishes to thin an ink, you should work it out on an ink stone, a piece of glass, or the back of an old press plate. (Using an old plate allows you to dispose of the plate after mixing the ink, instead of having to clean it.) If the body does need alteration, you should add only small quantities of the proper varnish, and keep a record of the amount you add so that you can duplicate the ink mixture again if necessary.

Tack

Tack is related to the body of the ink. It refers to its stickiness, or the force required to split an ink film between two surfaces. Tack is necessary to transfer the ink from roller to roller, to the plate, to the blanket, and to the stock. Tack is also necessary to ensure that the ink adheres only to the image areas, and does not flow to non-image areas of the plate. There must be a sharp break between the two. Tack is also important in multicolor work, where trapping of successive colors is required. The tack must be carefully adjusted, with the first down ink being tackiest and successive inks progressively less tacky. As you have already seen, use of cobalt driers leads to additional difficulty in multicolor printing.

Conversely, excessive tack is also a serious ink problem. The most common symptom of excess tack is "picking" of the paper, in which the ink tears off particles of the paper surface.

Drying of Inks

The drying of printing inks occurs when the ink changes from a fluid state to a solid state. It occurs in two stages: "setting", when the sheets can be handled without smearing; and "hardening", when final drying has taken place. Ink that has set-up properly can be handled without damage in successive operations.

Drying of ink involves chemical and physical actions, depending upon the vehicle used. The first type of drying action is that of "oxidation", in which the vehicle absorbs oxygen from the air. The oxygen changes the molecular structure of the oils in the varnish and they become solidified. The second drying action is known as "polymerization", in which smaller molecules of the vehicle combine into larger, more complex molecules. Most lithographic inks dry by a combination of oxidation and polymerization, in which the vehicle has solidified and formed a bond between the pigment and the stock.

The third drying action is that of "penetration". All inks used on absorbent materials have some penetration, but there is only one ink which dries exclusively by penetration. This type is known as "news ink" because it is used for the relief printing of newspapers. The vehicle is mineral oil, and it does not completely dry. This is the reason your hands may get dirty when you are reading the daily newspaper. As the vehicle is absorbed by the paper, the pigment is deposited on the surface, where it is readily rubbed off.

There are several other drying methods, which are included for your overall knowledge. Inks which contain resins in solvents dry by evaporation. The solvents evaporate, leaving a dry resin film on the stock. Examples of this type of drying are rotogravure and flexographic inks. Most of these inks required heat to accelerate evaporation. Some special purpose inks dry by "gelation", in which the resins from the vehicle form a film similar to gelatine on the surface of the stock. A recent development in the industry is that of drying by cooling, where the ink is applied in a molten state by heated rollers to stock which is run over chill rollers to set the ink.

Mixing Inks

Printing by offset lithography places a very thin film of ink on the finished page, as compared to the other printing processes. For this reason, it is best to use inks as concentrated and unreduced as possible. Most offset inks manufactured today are ready to use straight from the can. You should refer to the table in figure 15-12 if special conditions require the addition of driers, thinners and so on. After the ink can is opened, the cover sheet (usually oiled paper) should be completely removed. If a crust or skin has formed on the ink, it, too, should be completely removed and discarded. (If you use cartridge type inks, the first 1/4" of the ink from the spout should be discarded.) Then, with the blade of the ink knife, remove the desired quantity of ink and place it on the mixing stone. Do not gouge out chunks of ink; instead, skim off an even layer of ink with a circular motion of the blade. As you have already seen, the ink should be worked out with an ink knife or spatula. Larger shops have ink stones at each press if they do have a room where ink is mixed. Small shops use plates of glass or, as suggested, the back of an old press plate which may be discarded later. Draw the knife or spatula through the ink, spreading it in an even film on the stone. Work the ink in one direction, then work it at a right angle to that direction. Bring the ink from the edges into the center and work it out again to the sides. After the ink is worked to its proper consistency, you can work small quantities of the required additives into it, until the proper formulation is reached. Additives should be added gradually and thoroughly worked, even though considerable quantities are required, as might be the case in duplicating a previous ink order for a large job.

After the required quantities of ink are removed from the can, the remaining ink should be protected. For long term storage, a small disk of oiled paper should be placed firmly against the ink surface, working out all air bubbles. In the case of inks which are frequently used, some shops use a thin layer of water to prevent air from reaching the ink surface. The water is poured off before the ink is again used. You should not use a layer of oil to prevent skinning, as this may have an adverse effect on the vehicle. If your shop uses cartridge type inks, always replace the cap on the spout—after releasing the pressure on the ram of the ink gun. Replace the cap on all ink tubes after use.

COLOR

Almost all the work that you will run will be printed in black ink; fully 90% of all printing is in black. There may be jobs which will require color, although the use of more than one color of ink on a job is prohibited in Government printing except where the addition of color is of functional value. Examples of work which may require color are hydrographic charts or recognition charts of flags and pennants. For this reason, you are required to know the principles of color and the mixing of colored inks.

What is Color?

White light is composed of a series of light rays of varying length, of which violet rays are shortest and red rays longest, with blue, green, yellow and orange of intermediate lengths. The colors of red, green, and blue are known as the primary colors of light. If mixed in equal

	Reduces color depth	Reduces color strength	Softens (lengthens) ink	Stiffens (shortens) ink	Adds gloss	Decreases gloss	Speeds drying	Slows drying	Increases tack	Decreases tack
Additive	**Properties**									
Alumina hydrate *	x.	.x.	. .	. .	.x.	. .	. .	. .	.x.	. .
Blanc fixe	x.	.x.	. .	. .	. .	. .	. .	. .	.x.	. .
Castor oil	x.	.x.	.x.	. .	. .	. .	. .	.x.	. .	.x.
Covering (gloss) white	x.	.x.	. .	. .	.x.	. .	. .	. .	. .	. .
Kerosene	x.	.x.	.x.	. .	. .	.x.	. .	.x.	. .	.x.
Liquid (cobalt) driers	x.	.x.	.x.	. .	.x.	. .	.x.	. .	. .	.x.
Linseed oil (raw)	x.	.x.	.x.	. .	. .	. .	. .	. .	. .	. .
Linseed oil (boiled)	x.	.x.	.x.	. .	. .	.x.	. .	. .	. .	.x.
Magnesia powder	x.	.x.	. .	.x.	. .	.x.	. .	. .	.x.	. .
Mineral oil	x.	.x.	. .	. .	. .	. .	. .	.x.	. .	.x.
Mixing white	x.	.x.	. .	. .	. .	. .	. .	. .	. .	. .
Lard oil	x.	.x.	.x.	. .	. .	.x.	. .	.x.	. .	.x.
Oleic acid	x.	.x.	.x.	. .	. .	. .	. .	.x.	. .	.x.
Palm oil	x.	.x.	.x.	. .	. .	. .	. .	.x.	. .	.x.
Paraffin oil	x.	.x.	.x.	. .	. .	.x.	. .	.x.	. .	.x.
Paste (manganese/lead) driers	x.	.x.	. .	. .	.x.	. .	.x.	. .	. .	. .
Tallow	x.	.x.	. .	. .	. .	.x.	. .	.x.	. .	.x.
Varnishes:										
00000 (very light)	x.	.x.	.x.	. .	. .	.x.	. .	. .	. .	.x.
0000	x.	.x.	.x.	. .	. .	.x.	. .	. .	. .	.x.
000	x.	.x.	.x.	. .	. .	.x.	. .	. .	. .	.x.
00 (light)	x.	.x.	.x.	. .	. .	.x.	. .	. .	. .	.x.
0	x.	.x.	.x.	. .	. .	. .	. .	. .	. .	.x.
1	x.	.x.	.x.	. .	. .	. .	. .	. .	. .	. .
3 (medium)	x.	.x.	. .	. .	. .	. .	. .	. .	. .	. .
5	x.	.x.	. .	.x.	.x.	. .	. .	.x.	. .	. .
7 (heavy)	x.	.x.	. .	.x.	.x.	. .	. .	.x.	. .	. .
8 (body gum)	x.	.x.	. .	.x.	.x.	. .	. .	.x.	. .	. .
9 (body gum)	x.	.x.	. .	.x.	.x.	. .	. .	.x.	. .	. .
Vaseline	x.	.x.	.x.	. .	. .	.x.	. .	.x.	. .	.x.
Waxes	x.	.x.	.x.	. .	. .	. .	. .	. .	. .	.x.
Wool grease	x.	.x.	. .	. .	. .	.x.	. .	.x.	. .	.x.

*alumina hydrate tends toward livering of ink

57.571

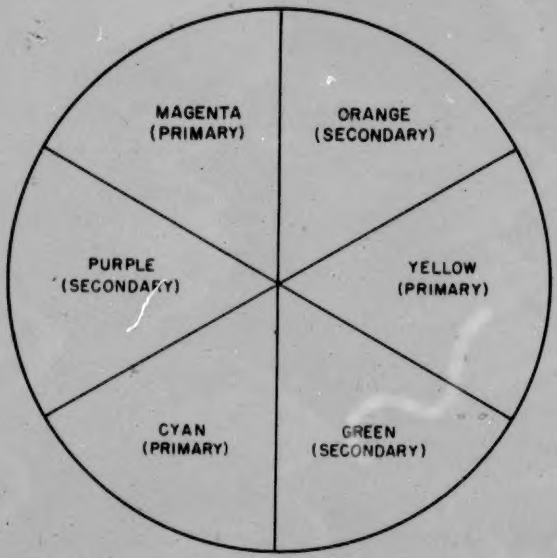
Figure 15-12.—Ink additives.

proportions, they produce white light. By overlapping beams of red and green light, yellow is produced; green and blue beams produce cyan; and a mixture of red and blue light produces magenta. This mixing of colors of light by overlapping light beams is known as "additive color".

Subtractive Color

In dealing with printing inks, we face the opposite side of the color picture. We deal not with light beams transmitted through various filters, but with the light that is reflected from the surface of an object. An object which appears red in daylight is red because its surface absorbs the green and blue portions of the white light and reflects the red portion of the spectrum. If a red light were directed toward the object, it would still appear red; but if a blue or green light were focused on it, the object would appear black, because the blue or green light would contain no red to be reflected from the surface. This phenomenon of selective absorption and reflection is known as "subtractive color", and occurs when inks, dyes and so on are mixed. Each of the materials has its own range of selective absorption; the final mixture has a combination of the absorption of all its components. As a result of this, the mixture always reflects less light than its components, or, in other words, it always subtracts some of the light reflected.

The primary subtractive colors are yellow, cyan, and magenta. Note that these are the colors resulting from a combination of the three primary additive colors. Cyan and magenta are often improperly called "process blue" and "process red", respectively. Mixing equal portions of yellow and cyan produces green; cyan and magenta produces purple; and magenta and yellow produces orange. These mixutres are called "secondary colors". If you refer to figure 15-13, you will see that the primary colors are located equidistant around the color wheel, and the secondary colors are located between their component colors. Directly across from each color is its complementary color. As you can see, the complement of magenta is green, a mixture of cyan and yellow. The complement of purple (a mixture of cyan and magenta) is yellow. Mixing a color and its complement produces a grayed color, usually undesirable. As you can see, white reflects all colors; whereas black absorbs all colors and reflects none, so it is, technically, not a color.



57.446(57B)

Figure 15-13.—Subtractive color wheel.

Mixing Inks for Colors

Except in full color (process) printing, you will seldom use the pure primary or secondary colors. Often the job originator will only specify that you use a "deep red" or "light green" for his job. In these cases you can use the color of ink that is on-hand straight from the manufacturer's can. Many times however, you will be required to match a color that has been specified by the originator. Since it is practically impossible to stock all the colors of inks available, ink manufacturers have devised a universally accepted system for matching the various color blends. This is commonly referred to as the Pantone Matching System (PMS).

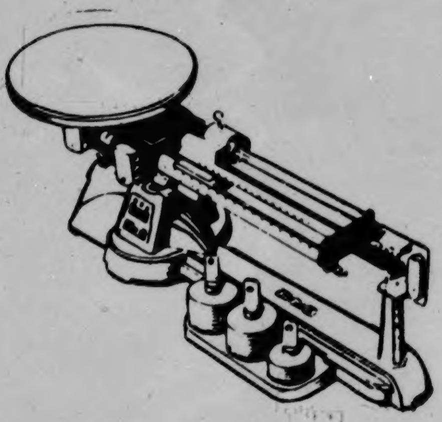
The PMS consists of nine basic colors (plus transparent white), a formula guide book, and a scale that is used to measure the correct portions of the basic colors that produce the blend desired. (See figure 15-14.)

The various PMS blends are identified by numbers. For instance, to obtain light green, #368, you mix 12 parts of the basic yellow ink with 4 parts of the basic blue ink. The term "parts" refers to the amount of ink used; in this case, if you needed a pound of the light green ink, full ounces would be measured on the scale. If you required only half a pound of it, the parts would be measured as ½ ounces.

Your shop may not have such a system, or there may be occasions when you cannot use it to obtain a special ink color match. Therefore, you should know the basic methods of mixing ink colors.

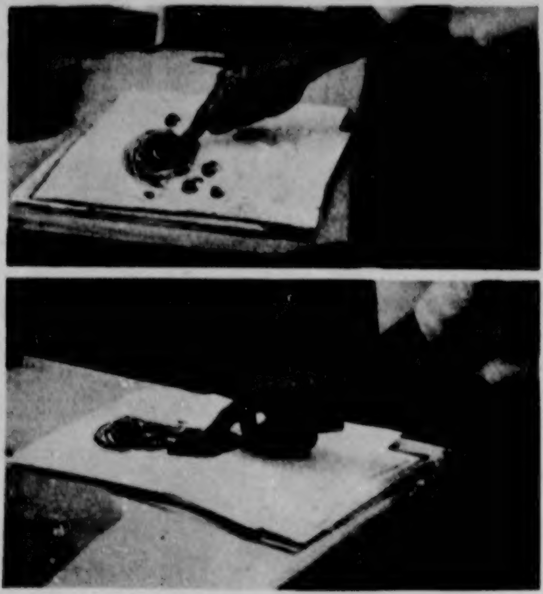
In speaking of colors, you should understand several precise terms. These are hue, chroma, and value. The color of the ink, blue, red, etc., is known as the "hue". Hue refers only to the color of the reflected light, and not to the amount reflected, or its intensity. "Chroma" refers to the intensity of the reflected color; its relative purity compared to gray. "Value" refers to the amount of light reflected by the color, compared to a maximum of white and a minimum of black. As a color is lightened, its value increases; as a color is darkened, its value decreases.

Before proceeding to actual color matching, several points of theory should be clear to you. The coloring properties of ink are dependent upon the pigment. The color of a mass of ink, such as its appearance in the open can, is known as the "masstone". The color of light reflected from a translucent film of ink, such as is laid down in offset printing, is known as the "undertone". The color of the printed image is a result of the combination of the reflection of the masstone and that portion of light transmitted through the ink by the paper, or the undertone. To make a good color match, both masstone and undertone must match. There are two methods of testing inks: the tapout and the drawdown. A tapout is done by placing a small, pea-sized amount of ink on a sheet of stock on which the job is to be printed, then working it with your fingertip in a circular motion, gradually extending the ink to a fine film at the edge. The center of the circle, containing the darkest ink, is the masstone. The thin film at the edge reveals the undertone. A drawdown is similar; a small amount of ink is placed on the sheet, then drawn into a long streak on the sheet with the blade of the ink knife. Both tapouts and drawdowns are illustrated in figure 15-15.



57.760

Figure 15-14.–An ink scale.



57.447(578)

Figure 15-15.–Tapout, above; drawdown, below.

You should also determine whether an opaque or transparent ink is required. If you are printing on colored stock, you should use an opaque ink to keep the color of the stock from blending with the undertone of the ink, possibly destroying the color balance. If you are overprinting a halftone, you will need a transparent ink so that the halftone will show through. For most map and chart work, you will use transparent colors. Inks for full color (process) work are usually transparent, although some first-down yellows are opaque. The relative opacity or transparency of some commonly used inks are shown in figure 15-16.

As you have seen, mixing a color with its complement will gray the resulting color. In mixing color, care must be taken to avoid using component inks which contain the complements. As an example, you know that a mixture of cyan (blue) and magenta (red) produces purple. There is none of the third primary color, yellow, in this mixture. Some blue inks tend toward greenish, while others are purplish; some red inks are on the orange side, while others tend toward the purple. A combination of the inks containing some yellow (a blue-green and red-orange) will give you a gray purple; the other inks will produce a truer purple.

It is always necessary to obtain the correct color or hue, before proceeding to change its value, or to change the purity or chroma. Changing the value of a color is accomplished by adding black, resulting in a shade; or by adding white, resulting in a tint. Changing the chroma is done by adding the complement to gray the color.

In mixing colored inks, the darker color is added to the lighter in small quantities. As you add color, you should mix it thoroughly and work it out, then tap it out or draw it down to check masstone and undertone before adding more color.

Color Harmony

As a Navy Lithographer, you will probably not be concerned with color harmony, which is the balance of color to make a printed piece pleasing to the eye. When you are required to run color, it will be according to some standard color plan, used for a specific purpose. The colors of various topographic features on maps, for instance, are standardized.

In those instances where color decisions are made in your shop, the following principles should be applied:

1. The warm colors (red, orange, and yellow) excite the eye. They are attention-getters. Yellow represents light, and attracts the eye best. Red is warmest and most exciting. It may actually be irritating to the eye.
2. The cool colors (blue, green, and purple) are restful and relaxing. Blue is coldest and most restful. Some blues and purples are so cool they actually repel the eye. Green is considered the most relaxing.
3. Strong colors (those with high chroma) are used when the color area is very small. As the size of the area increases, chroma should decrease; that is, the color should be grayed. You can obtain similar results by using tints (colors of high value) when large areas are to be covered.
4. When two colors are used, a primary and its complement present pleasing combinations. It is best to use the warmer color in the small areas, and the cooler complement in the larger areas.
5. When black is used with a cool color, it should have a red undertone, or have a small amount of red added. Conversely, if black is used with a warm color, the black should have a blue undertone, or have some blue added.

Letterpress Inks

If you work in a combination (offset-letterpress) shop, you will have occasion to use specially formulated letterpress inks. Letterpress inks should not be used on offset presses, but offset inks may be used on letterpresses. However, for best results these inks should not be used interchangeably except in emergencies.

As you have already seen, the "news ink" made for letterpress printing of newspapers has a mineral oil vehicle. News ink should not be used on other than newsprint or poster stock, as it will not dry properly and the image will have a gray, washed-out appearance.

Color	Relative Opacity	Permanence	Drying	Workability
Blues				
Alkali	transparent	fair	slow	excellent
Monastral (process)	transparent	excellent	good	fair
Milori (iron) (bronze)	semiopaque	good	good	good
Peacock	transparent	very poor	fair	fair
Tungsten (process)	transparent	good	fair	good
Browns				
Iron Oxide	opaque	excellent	good	poor
Para	semiopaque	good	fair	good
Greens				
Chrome	opaque	good	good	fair
Chrome Oxide	transparent	excellent	good	fair
Tungsten	transparent	good	fair	good
Milori	semiopaque	good	good	good
Oranges				
Chrome	opaque	good	good	good
Lake	transparent	poor	fair	poor
Molybdate	opaque	good	fair	excellent
Permanent	opaque	good	good	excellent
Purples				
Molybdate	transparent	good	fair	fair
Tannate	transparent	poor	poor	good
Tungsten	transparent	good	fair	fair
Reds				
Cadmium	opaque	excellent	good	poor
Lithol	semiopaque	fair	fair	good
Lithol Rubine	semiopaque	good	fair	good
Madder Lake	transparent	good	fair	fair
Phloxine (process)	transparent	fair	good	good
Red Lake	transparent	fair	good	good
Rhodamine (process)	transparent	good	fair	good
Scarlet	transparent	good	fair	fair
Toluidine	opaque	good	fair	good
Vermillion	opaque	good	good	poor
Watchung	semiopaque	good	good	good
Yellows				
Benzidine (process)	transparent	poor	fair	good
Cadmium	opaque	excellent	good	fair
Chrome	opaque	good	good	good
Hansa	semiopaque	good	fair	good
Lake	transparent	poor	fair	poor
Whites				
Alumina Hydrate	transparent	good	good	good
Gloss White	transparent	good	good	good
Lead oxide	opaque	good	good	good
Titanium	opaque	excellent	good	excellent
Zinc oxide	opaque	good	good	good

113.249

Figure 15-16.—Properties of colored inks.

The ink most suitable for the general run of letterpress work is called "job ink". It is a short ink, with good depth of color. "Bond ink" is made specifically for printing on bond and similar stocks. It is extremely short and generally has a high gloss. For halftone work, a long, soft-bodied, ink is made. Although it is almost as fluid as news ink, halftone ink covers well and dries quickly.

Other inks made for letterpress include: cover, for cover stocks; cellophane, for cellophane and acetate; book, for cylinder presses; magnetic, for bank check processing; and so on.

INK ROLLER CARE

As you have seen, the ink is distributed by a system of steel and composition or rubber rollers. Rubber rollers are made by attaching strips of rubber to hardened steel cores, then vulcanizing and curing them under pressure and heat. The roller is then ground to the proper size on a lathe. Steel rollers are machined to the proper diameter and sometimes plated to present a more ink receptive surface.

The surface of rubber rollers must be waterproof and fairly resistant to the driers and vehicles in the ink. Some types of driers and vehicles cause swelling of rubber rollers, so they should be used with caution and in small amounts. When possible, the rollers should be removed from the press, cleaned thoroughly, and allowed to rest after swelling. Rollers should be stored is a cool dry place, as heat, moisture and light may cause deterioration. Several sets of rollers should be on hand for each press, and they should be rotated from time to time. All rollers should be stored in racks (preferably vertical) when not in use, so that they will not develop flat spots from resting on a shelf. If a rack is not available, rollers may be stored vertically, resting on the shaft end. Use care to prevent burrs on the shaft ends.

Glazing and Stripping

If press rollers are not properly cleaned at the end of the work day, the ink vehicle and drier may be absorbed by the rubber and dry to form a hard, shiny surface. This is known as "roller glaze". You can generally remove it by washing the rollers with a solvent and fine pumice, followed with a lye water bath. A solution of 4 to 6 tablespoons of caustic soda (lye) in a gallon of water is adequate. CAUTION: Lye is corrosive and can cause severe skin and eye burns, so you should wear rubber gloves and avoid splashing when working with the solution.

"Stripping" is another type of roller trouble. It occurs when the acid in the fountain solution makes the steel rollers ink repellant. The gum arabic used in the fountain solution is a natural desensitizer. When used to excess, it will cause stripping. If this happens, the rollers must be counteretched so they will again become sensitive to the greasy ink. You can use a solution of 2-percent nitric acid or a 28-percent acetic acid solution as a counteretch. After the rollers are washed with solvent, the acid etch is applied with a wad of cotton. The roller is then scoured with pumice.

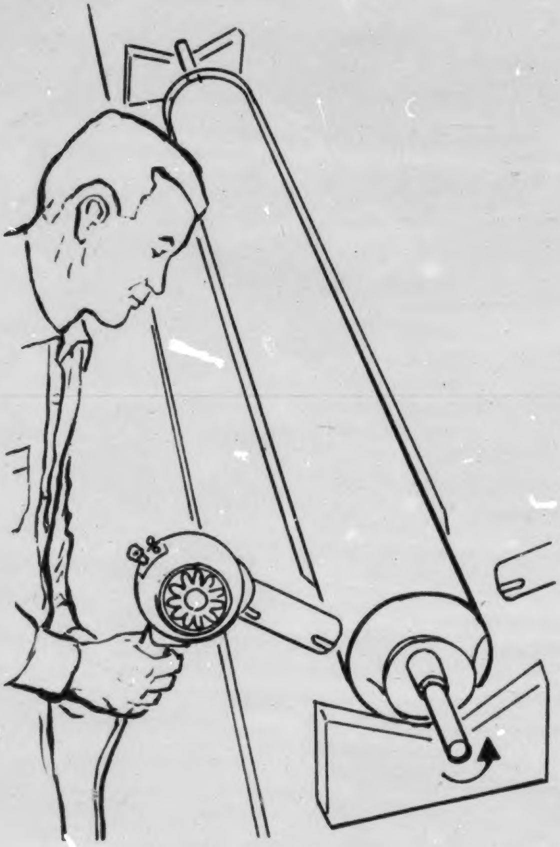
Stripping is almost always caused by excessive water, so the flow of dampening solution should be carefully regulated. The fountain solution should also be checked for proper acidity.

Some press manufacturers have copperplated the steel rollers in the inking systems. This is because copper has a natural affinity for ink, while steel repels it. Chromeplated steel rollers are often used in the dampening system in place of brass because chrome repels ink. If your presses are equipped with steel ink rollers, you may be able to reduce stripping problems by having them copperplated during your next yard overhaul or tender availability.

Teflon Roller Covers

A new application has been found for the recently developed non-stick surface used on frying pan, griddles, and so on. DuPont has marketed a transparent flourocarbon resinous material, called Teflon, in the form of a tube or sleeve to be slipped over the ink rollers. Once a Teflon cover has been slipped on a roller, heat (220° F) is applied with a commercial hot air gun, as shown in figure 15-17. The heat shrinks the cover and produces a tight fit. The roller is rotated during the shrinking process as indicated by the arrow in the illustration.

Teflon has an excellent affinity for ink. It also reduces hickies since it attracts and holds dirt



57.662

Figure 15-17.–Applying a Teflon cover to an ink roller.

particles. Furthermore, particles of Teflon will not break off to produce hickies, as sometimes happens when you are using unprotected compositions or rubber rollers.

Washup solutions, varnish, and gum penetrate into some roller surfaces and cause them to become slick and glazed and to lose affinity for ink. Metal rollers also lose their affinity for ink and strip. Because the surface of Teflon is nonporous, it resists ink buildup and cleans completely so stripping, glazing, and pitting are eliminated. Since the rollers will not carry water or fountain solution, they cannot become desensitized and strip. The rollers can be cleaned easily and completely with any type of solvent. The Teflon covers eliminate hand scrubbing and the use of lye solutions.

Teflon covers cannot improve a roller that is already in poor condition, however. The rollers to be covered must be ground and uniform because an uneven surface may prevent proper roller contact and result in spotty inking. For this reason, only new or reground rollers can be covered. If you have the proper equipment on hand, you can cover the rollers yourself; if you do not, you can send them out for covering. In either case, it is a good idea to have the rollers reground before applying the Teflon covers.

Although Teflon can be used on form rollers, it sometimes causes aluminum plates to wear if the rollers are not carefully adjusted. Teflon also tends to wear when a wash-up attachment is used against the rollers. Therefore, some shops do not cover the roller that is contacted by the blade of the wash-up attachment.

Teflon covers come in diameters ranging from 1.25″ to 8″. The thickness of the material is 0.020″.

INK DIFFICULTIES

Before you can identify problems associated with the ink on the press, you must understand the definitions relating to them. (Refer to Table 15-1 for specific inking problems and their solutions.)

Back-off refers to ink which does not follow the roller in the fountain. It may occur over the entire length of the roller or just in spots. Chalking occurs when the vehicle does not form a bond between the pigment and the paper and allows the pigment to powder or rub off the sheet. Inks crystalize by drying from the top down, forming a crust which repels other inks. Embossing of the blanket occurs when inks are so stiff that they impress the image into the surface of the blanket.

Emulsification of inks can occur in two forms. When the water emulsifies in the ink, small droplets of water are carried up into the film of ink on the rollers. Generally, this is not a serious problem. In some cases, the image will become grayed, however, and the pressman may increase the ink flow, thus causing fill-in. In an effort to remedy this, the pressman may then increase the water flow and a vicious circle has begun. When the ink emulsifies in the water, it backs up into the dampening system and is redeposited on the plate as an overall tint. This condition is more serious than water in the ink, and will often necessitate the washup of the entire dampening system.

Filling-in of the image is most noticeable in halftones and reverse images. Ink spreads from the image areas into the non-image areas, giving a muddy appearance to the halftones and plugging up the fine lines and serifs in reverses. Roller glaze is an overall glossy appearance on rubber and composition rollers. It consists primarily of dried varnish. When inking properly, the rollers should have a velvet-like sheen. Hickies are small doughnut shaped spots in the image areas, caused by dried ink, paper dust, or other dirt.

Livering is a generally uncorrectible condition of the ink, caused by a reaction between additives and the vehicle. It is characterized by a gelatine- or liver-like apparance of the ink. Misting refers to the action of a soft ink in breaking away from the rollers and spraying about the pressroom. Mottling is a term used to describe an uneven appearance of the printed image. It is most often seen in large solid areas. Offsetting describes the transfer of fresh ink from the front of one sheet to the back of another when they are stacked together. It is sometimes called "setoff" to distinguish the problem from the printing process. Picking is a condition in which the surface of the paper is broken or torn due to the stiffness of the ink. It occurs most often with cheaper grades of coated stock. Piling occurs when the ink does not transfer from the plate to the blanket, or from the blanket to the paper. As the ink builds up, it will emboss the blanket and possibly ruin the plate.

Ink is being poorly distributed when it does not flow evenly over the roller surfaces. Poor trapping refers to the inability of the first colors printed in multicolor work to accept the successive inks. Scum is a localized condition of the plate, in which the ink adheres to non-image areas of the plate in certain spots. Show-through refers to a condition in which some of the pigment and vehicle are absorbed by the paper to create a reverse image on the back of the sheet. It is often confused with offset; but it is always in register, whereas offset is generally not in register.

Smudging is similar to chalking, but the pigment is not completely rubbed off; it is transferred or smeared over another portion of the sheet in the partially dried vehicle. Stripping is the refusal of the rollers to take ink. It occurs on the rubber or composition rollers that have become glazed, and on steel rollers that have become desensitized to ink. It may be an overall condition or it may be spotty. The printed image may be scratched after the ink has dried. The condition may be confused with chalking, but it is only the surface of the image that is affected. It is primarily a problem in package printing.

Tinting is the overall deposit of ink in the non-image areas. The tint may be wiped from the plate with a light touch of a sponge or fingertip, but it will probably reappear when the dampeners are dropped on the plate. It differs from scum in that scum cannot be wiped off easily, and generally does not reappear.

Table 15-1.—Ink problems and remedies

Problem	Cause	Remedy
1. Back-off	1. Ink does not follow fountain roller	Work ink thoroughly before placing in fountain
	2. Ink too short	Work in No. 0 or 1 varnish (1/4 oz. per lb.)
2. Bleeding pigment (see Tinting)		

57.682.1

Table 15-1.—Ink problems and remedies—continued

Problem	Cause	Remedy
3. Chalking (often not noticed until job is run; if this is the case, overprinting is the only remedy)	1. Vehicle absorbed too rapidly to form bond	Add No. 8 or 9 varnish (body gum) (1/4 oz. per lb.)
	2. Not enough drier	Add paste drier (1/2 to 1 1/2 oz. per lb. or liquid drier (1/4 to 1 oz. per lb.)
	3. Wrong ink	Overprint with overprint varnish
4. Crystallization	1. Cobalt drier	Substitute paste drier
5. Drying on rollers	1. Too much drier	Reduce amount of drier
	2. Wrong formula ink	Change to slower drying ink
6. Embossing	1. Ink too stiff	Reduce body with No. 00 or 0 varnish (1/4 oz. per lb.)
	2. Too much drier	Reduce amount of drier or change from liquid to paste drier
7. Fill-in	1. Too much ink	Reduce ductor dwell or tighten fountain keys
	2. Ink too soft	Add No. 8 or 9 varnish
8. Glazing	1. Dried ink on rollers	Clean rollers thoroughly with pumice and lye water
	2. Dried ink on blanket	Clean thoroughly with solvent and pumice
9. Hickies	1. Particles of dried ink	Remove all skin from ink before placing in fountain
	2. Paper dust	Clean edges of paper pile
	3. Dirt from overhead	Clean overhead above press
10. Livering	1. Poor ink formulation	Replace ink in fountain
	2. Alumina hydrate used as extender	Replace ink, use blanc fixe or gloss white
11. Misting	1. Ink too soft	Add No. 8 or 9 varnish
	2. Press speed	Slow down press
	3. Too much ink	Reduce ductor dwell or tighten fountain keys

57.682.2

Table 15-1.—Ink problems and remedies—continued

Problem	Cause	Remedy
12. Mottling	1. Too much ink	Reduce ink film; increase intensity of color
	2. Ink too greasy	Add No. 5 or 7 varnish to increase body
13. Offset	1. Too much ink	Reduce at fountain
	2. Not enough drier	Add cobalt drier (1/4 to 1 oz. per lb.) or paste drier (1/2 to 1 1/2 oz. per lb.)
	3. Fountain solution too acid	Reduce acidity to pH of 4.5 to 5.5
	4. Ink too heavy	Reduce with No. 0 or 00 varnish
	5. Static electricity	Use static eliminator or tinsel
14. Picking	1. Ink too tacky	Reduce body with No. 0 or 00 varnish
	2. Poor paper quality	Replace if possible; reduce ink as above
15. Piling	1. Ink too stiff	Reduce with No. 0 or 00 varnish
	2. Ink emulsified	Clean up; adjust water and ink
16. Plate Wear	1. Too much drier	Change to paste drier; use less
	2. Fountain solution too acid	Adjust to pH of 4.5 to 5.5
	3. Too little ink	Increase ink flow to protect image
17. Poor distribution	1. Ink too stiff	Reduce with No. 0 or 00 varnish
	2. Glazed rollers	See above
	3. Uneven flow from fountain	Adjust fountain blade
18. Poor trapping	1. Cobalt drier	Use paste drier in all but last-down color
	2. Improper tack	Adjust tack with varnish: first down color tackiest, others successively less tacky
	3. Too much time between colors	Run other colors as soon as possible; generally as they set-up

57.682.3

Table 15-1.—Ink problems and remedies—continued

Problem	Cause	Remedy
19. Scum	1. Ink too soft	Increase body with No. 4 or 5 varnish
	2. Too much ink	Reduce flow at fountain
	3. Improper fountain solution	Adjust pH to 4.5 to 5.5
	4. Too much drier	Reduce amount of drier
	5. Dirty dampener rollers	Replace roller covers
20. Show-through	1. Paper too absorbent	Replace paper if possible
	2. Ink thinned with solvent	Replace ink with one thinned with No. 0 or 00 varnish
21. Slow drying	1. Not enough drier	Add proper drier
	2. Paper too acid	Replace if possible
	3. Fountain solution too acid	Reduce to pH of 4.5 to 5.5
22. Smudging	1. Not enough drier	Add proper drier
	2. Drier not mixed thoroughly	Remove ink from fountain and rework
23. Stripping	1. Glazed rollers	See above
	2. Desensitized rollers	Etch rollers
	3. Too much water	Adjust water/ink balance
	4. Fountain solution too acid	Adjust pH to 4.5 to 5.5
24. Surface scratch	1. Not enough drier	Add drier, cobalt if possible
	2. Too much ink	Adjust ink flow
	3. Non-resistant ink	Add wax compound (only to last-down ink)
25. Tinting	1. Ink too soft	Add No. 5 or 7 varnish
	2. Fountain solution too acid	Adjust to pH of 4.5 to 5.5
	3. Not enough water	Clean up and adjust ink/water balance

57.682.4

CHAPTER 16

BINDERY EQUIPMENT

The last stop for nearly all jobs that go through a print shop is the bindery section. Bindery work includes such operations as cutting, stapling, stitching, folding, collating, padding, drilling, and wrapping the completed job. Naturally, the number of bindery operations performed depends on the type of job. A simple form used in the ship's office may only need to be padded and wrapped to complete it. On the other hand, an order of Welcome Aboard booklets for new personnel reporting aboard your ship may need to be folded, collated, stitched, trimmed, and wrapped before it is complete. But the majority of the time the bindery or finishing operations will be a small part of the whole job.

Regardless of the number of bindery operations or the length of time it takes to process a job in the bindery, you must keep in mind the importance of doing the work correctly. One mistaken measurement or instruction in the bindery can mean that the complete job will have to be re-run. Re-runs are not only a waste of time and materials, but they can disrupt the workload schedule in the shop. Another point that deserves special emphasis when you are working in the bindery is safety.

SAFETY IN THE BINDERY

Accidents are caused; they don't just happen. Safety first isn't just another slogan when it comes to operating bindery equipment. There are several safety measures you must observe whenever you are operating any type of equipment.

- First of all, never operate any equipment unless you are thoroughly familiar with its controls and operating procedures. When in doubt, check the manufacturer's instruction manual or get assistance from a qualified operator.

- Use ALL the built-in safety features and guards on the equipment you are operating. Don't remove side plates or covers because it's easier to clear a paper jam when they occur. Never attempt to cheat a safety device.

- Never attempt to clear a jammed machine unless you have secured (disconnected) the power first.

- Check your clothing for loose, dangling ends before operating equipment. Don't use long rags that can easily become tangled in moving parts. Keep tools such as screwdrivers, rulers, and small wrenches clear from operating machinery.

- Stop all equipment before oiling it. Never lubricate running machinery.

- Operate electrical equipment only if it has been properly safety checked and tested. Don't attempt to make electrical repairs yourself; call an electrician.

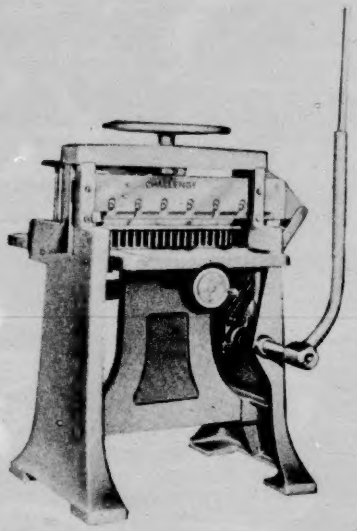
- Practice good housekeeping. Don't let paper or other materials pile up around machinery. Use waste receptacles.

- Keep your mind on your job. Many bindery operations are boring and tedious and you may let your guard down: a smashed or missing finger could result from a few moments of inattention.

- Call attention to any unsafe work practice. No one willingly wants an accident to occur, but they usually aren't aware that what they are doing is unsafe. Remember–better safe than sorry.

PAPER CUTTERS

The paper cutter shown in fig. 16-1 is typical of the hand operated paper cutters found in many smaller shops. These cutters are also called lever cutters, because a lever is used to force the knife through the paper. The knife is lowered when the lever handle is pushed down and raised when the lever is returned to its upright position.



57.448X

Figure 16-1.—Hand operated paper cutter.

The cutters shown in fig. 16-2 are similar to hand (lever) cutters except they are power operated. To lower the knife, you must push or pull two levers or buttons with each hand. This is a safety feature to ensure that you will always have both hands clear of the knife when the cut is being made. After the cut has been made, the knife automatically returns to its original position.

With either type of paper cutter, lever or automatic, a clamp is used to prevent the paper lift from slipping when the cut is made. A paper lift is the term that describes the stack of paper that is placed on the cutter table. On some cutters the clamp is raised and lowered by means of a large handwheel on top of the cutter, as shown in fig. 16-2. On other models, usually the power equipped type, the clamp is automatically lowered just before the knife descends through the paper. There are handwheel operated clamps on power cutters also.

Always place a piece of chipboard (light card stock used as backing for pads or tablets) on the top and bottom of each paper lift before cutting it. The chipboard on the top will prevent the paper clamp from indenting the sheets as it holds them. The chipboard on the bottom of the lift assures that the cutting knife will cleanly pass through the paper to the cutting stick.

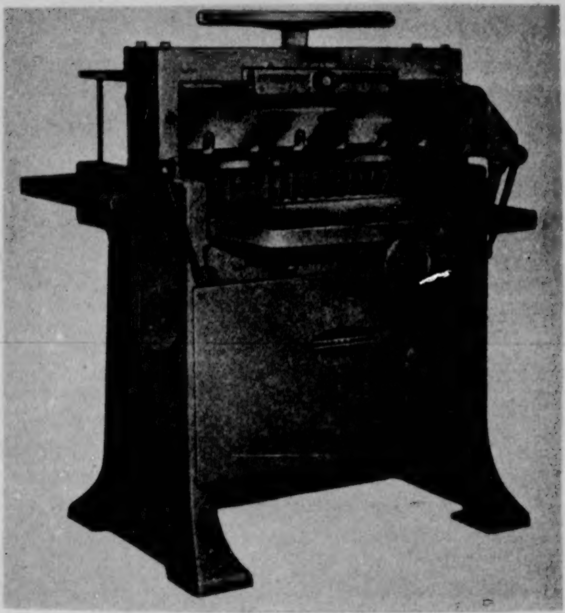
The cutting stick is a square piece of hardwood or plastic which fits into a groove along the cutter table. It prevents the knife blade from being damaged when it comes to rest on the cutter table after each cut. The knife cuts through the paper and slightly into the stick with each cut. In time, the stick will become worn and the cutter will then stop cutting completely through the lift. You then will have to turn the stick over, or replace it once all four sides have been used. A cutting stick is easily removed from the groove in the table by prying it up from either end with a screwdriver.

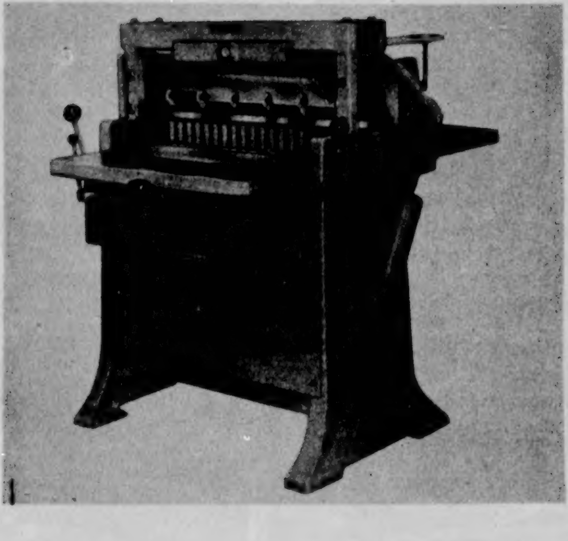
Continued use of the cutter causes the knife to become dull. A dull knife, or one that has become chipped, affects the quality of the cut, leaving ragged or rough edges on the paper. The knife may be sharpened, but it is a process requiring special equipment and training. Every shop should have at least one spare available to replace the one in use.

Unlike changing a cutter stick, the replacement of a cutter knife is a difficult job. You should not attempt to do it alone. The knife must be adjusted so that it rests evenly, and just barely on the cutting stick. Consult the manufacturer's instruction manual for the correct knife replacement procedures for your particular cutter model and remember all safety precautions.

OPERATING A PAPER CUTTER

Sheets of paper are loaded onto the cutter table in small stacks or lifts. The height of the





57.449(57C)X

Figure 16-2.—Power paper cutters.

lift varies according to the type of paper and the cutting capacity of the cutter.

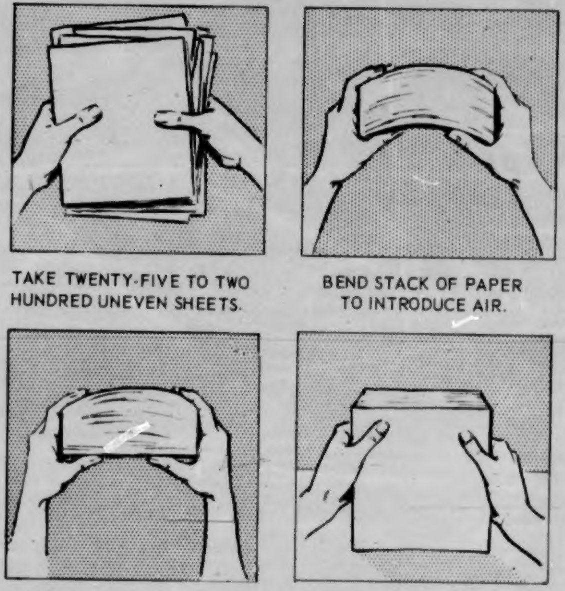
The sheets are jogged (evenly aligned) against an adjustable metal bar called a back gage and one side of the cutter table. The distance between the back gage and the point where the knife descends determines the width of the cut. The knife position never changes, but you can move the back gage forward or backward by turning the handwheel located at the front and below the cutting table.

On most cutters, the cutting distance is indicated on a sliding metal tape which passes from the back gage through a viewing window at the front of the cutter. The tape is calibrated to 1/16 of an inch and makes it possible to quickly and accurately position the back gage.

On cutters not equipped with a sliding tape measuring device, you must use a rule to measure the distance from the back gage to the point where the knife indents the cutting stick. Never use a metal rule to take this measurement because you may forget and leave it on the cutting table in the path of the knife when the cut is being made. This metal to metal contact will damage the knife.

Once you have set the back gage, you must lock it in position with a locking screw or lever which is located on the back gage handwheel. The locking device prevents the back gage from moving as the paper lift is jogged against it. Naturally, before the cutter can be reset for a different cut, the locking device must be released. When you are jogging the paper against the back gage, don't use excessive force or you will eventually mis-align the back gage.

Each lift should be jogged until the edges are as even as possible. (See fig. 16-3.) Once you get the hang of it, you will find that jogging paper is a fairly simple matter. Large sheets are more difficult to handle however. You should riffle the lift slightly to introduce a blanket of air between the sheets. Then raise the lift slightly and shove the stock loosely against the back gage and side of the cutter simultaneously. Many operators use a smooth, rectangular, block of plastic or wood to tap the exposed edges of the lift. This helps to ensure that the stock is resting firmly against the side and back of the cutter. You will also find that if you fold large sheets in the manner shown in figure 16-4 it will be easier



TAKE TWENTY-FIVE TO TWO HUNDRED UNEVEN SHEETS.

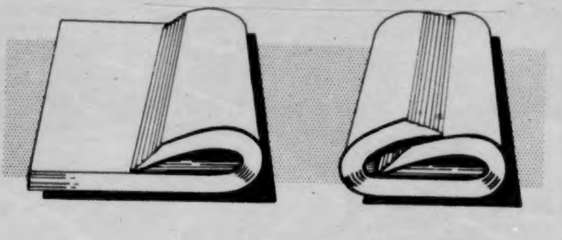
BEND STACK OF PAPER TO INTRODUCE AIR.

STRETCH BOTTOM SHEETS TAUT TO INTRODUCE A BLANKET OF AIR BETWEEN EACH SHEET.

DROP PAPER AGAINST TABLE TO JAR UNEVEN SHEETS IN PLACE.

57.452

Figure 16-3.—How to jog small sheets.



57.453

Figure 16-4.—Overlapping large sheets in this manner make them easier to handle.

for you to handle them when you are loading or unloading the cutter.

How to Trim Paper

When you are trimming paper on four sides, remember to make the first two cuts slightly oversize. This will allow for a little trim on the other two sides when you trim them to the final size.

Always place the guide or most even side of your paper against the back gage when you make your first cut. When you make your second cut, turn the paper and jog the smooth-cut edge against the side guide so that this cut will be at right angles to the first one. When making your third and fourth cuts, set the back gage to the final dimensions for the sheets. It is not necessary to push the paper against the side guide after the second cut. If you use only the back gage, you should try to center the stock on the table, however, so as to minimize pressure on the weaker ends of the gage.

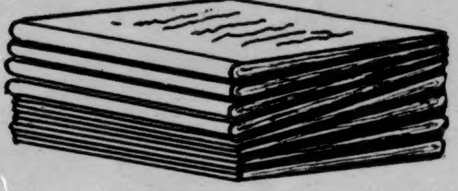
How to Trim Books

When books or pamphlets are trimmed, you should set the cutter for the desired distance and place them in the machine with the bound edge (backbone) toward the back gage. There are attachments called book guides, which clamp onto the back gage. These guides will hold down the back edges and prevent the books from slipping. If book guides are not available, you should bring the clamp down slowly while lightly forcing the books against the back gage with a block of wood or plastic. Cut all of the books along the face (right side) before resetting the cutter. Then reset it for the foot (bottom) cut.

In order to equalize the pressure of the clamp on the stack of books during the head and foot cuts, you should flop the top half of the stack over from right to left. (See fig. 16-5.) This will give the stack an equal amount of backbone on each side, and allow the clamp to exert its pressure evenly.

After making the foot cut, reset the back gage and make the head cut. Leave the books stacked just as they come from the cutter for ease in wrapping after the job is completed.

On some paper cutters, the back gage is built in 3 sections which may be set together or separately. You can set the center section for trimming the face of the books and the side sections for trimming the head and foot. Using this method, you can work out a production system that will produce a stack of books



57.454
Figure 16-5.—How to stack books for trimming along the top and bottom.

trimmed on 3 sides every time the knife descends.

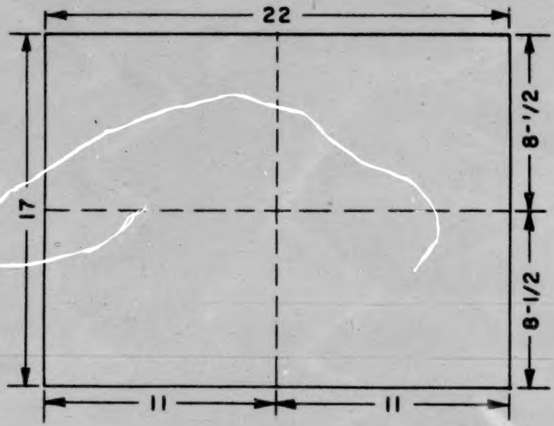
Cutting From A Stock Sheet

Estimating how much paper stock will be required for a particular job is an important operation. You must cut the largest possible number of pieces from the stock or prime sheet.

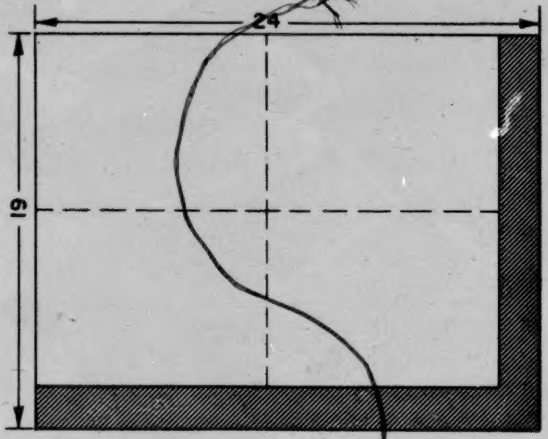
If it is necessary to cut the stock sheet in halves or quarters, you will have no trouble. (See fig. 16-6.) But if the required size doesn't cut out of the stock sheet evenly, you must figure out how to cut the sheet with the least amount of waste.

Suppose you must cut 3" X 5" cards from 22 1/2" X 28 1/2" stock. You should figure the 3-inch cut along both the 22 1/2" and the 28 1/2" dimensions. You should also try the 5-inch cut both ways to see which works out better.

5 X 3	3 X 5
22 1/2 X 28 1/2	22 1/2 X 28 1/2
7 X 5 = 35	4 X 9 = 36



You can cut four 8½" × 11" pieces from a 17" × 22" stock sheet with no waste . . .



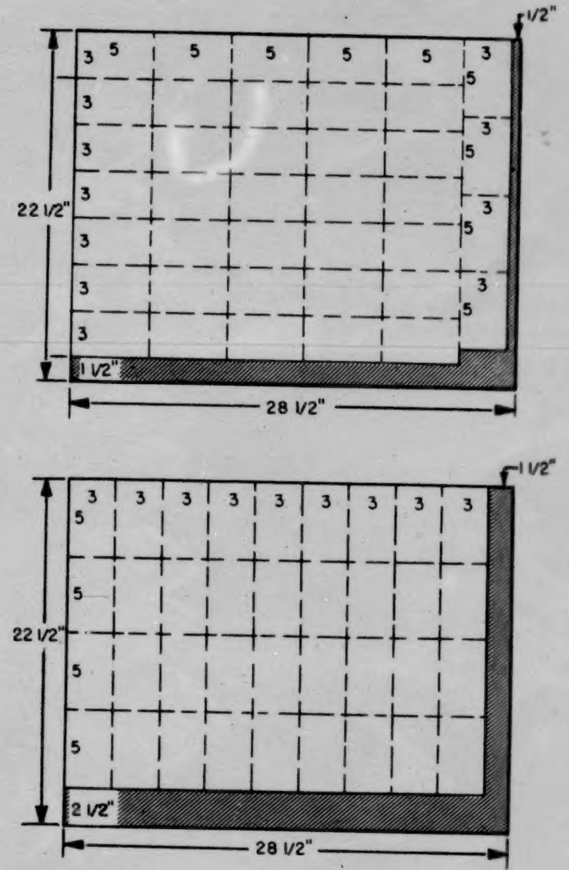
. . . While the same cut from a 19" x 24" sheet leaves considerable waste.

57.455
Figure 16-6.—Cutting paper from a stock sheet.

By the process of cancellation, you will find that in the first case, 3 goes into 22 1/2 seven times, and 5 goes into 28 1/2 five times. This means that you can make seven 3-inch cuts along the 22 1/2-inch side, and five 5-inch cuts along the 28 1/2-inch dimensions. Seven times five is 35, which is the number of 3 X 5 pieces that can be cut from one 22 1/2" X 28 1/2" stock sheet.

In the second case, four 5-inch cuts can be made along the 22 1/2" side, while nine 3-inch cuts can be made on the 28 1/2-inch side. Nine times four is 36—so you'd apparently get more pieces by using the second method.

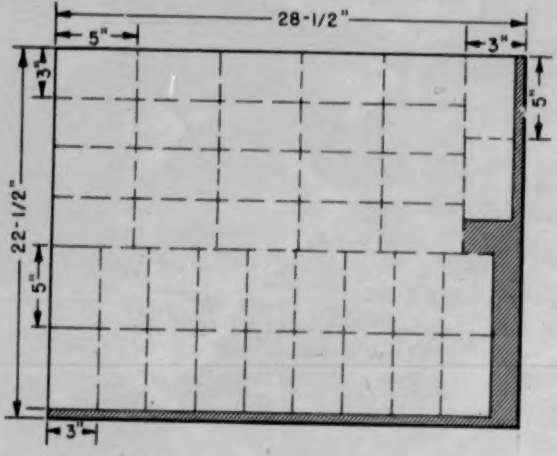
However, the trim must also be considered. In both cases you have something left over after the cuts just described. In the first case the trim amounts to 1 1/2 inches on one side and 3 1/2 inches on the other. In the second case, it is 2 1/2 inches on one side and 1 1/2 inches on the other. You should make a diagram of the stock sheet, like that shown in figure 16-7, to see if



57.456
Figure 16-7.–Two ways of cutting 3" X 5" cards from a 22 1/2" X 28 1/2" stock sheet.

you can find a way to utilize your trim. You will notice that the trim in the second case is useless, but in the first case it can be used to make 4 extra pieces of the required (3 X 5) size. You can add these to the 35 you already have, making a total of 39 pieces by this method.

But this business is tricky. If you use a different arrangement, like the one in figure 16-8, you will find that you can get 40 pieces out the sheet. Try several arrangements–then use the one that will give you the most pieces.



57.457
Figure 16-8.–A different arrangement sometimes yields more pieces per stock sheet.

Figuring Stock Sheets Required

Once you know how many pieces can be cut from a single stock sheet, it is a simple matter to determine how many stock sheets will be needed for a job. Just divide the total number of pieces required by the number of pieces you can cut from one stock sheet. For example, suppose your job calls for 15,000 finished pieces, size 3" X 5". As you have just seen, you can get 40 such pieces from a 22 1/2" X 28 1/2" stock sheet, so divide the 15,000 by 40. This gives you 375, which is the number of stock sheets you will need. Of course you must allow extra sheets for spoilage. Cutting a few extra sheets at the beginning is cheap insurance against an incomplete job or a press shut down waiting for additional paper. As a general rule you should allow about 10 percent for waste on runs of 500 or less, but on the longer run jobs this can be reduced to 2 to 3 percent.

Care of the Cutter

Under normal conditions, little maintenance is required for paper cutters. When you are operating a power cutter, be alert for a downward creep of the knife blade after it has returned to its original position upon completion of the cut. This signals that the clutch mechanism, which operates similarly to an automobile brake, is wearing and requires adjustment. Since the adjustment procedures vary from one type of cutter to another, consult the operator's manual for the adjustment instructions for the particular cutter in your shop.

The cutter table and other machined surfaces should be cleaned monthly. In many shops, a light coat of wax is applied to the table surface after it has been cleaned. In addition to protecting it from rust, the wax provides a smooth, hard coating to the table.

FOLDING MACHINES

In large commercial shops, and in the Navy's printing plants ashore, folding is a major bindery operation. Large folding machines, similar to those shown in figures 16-9 and 16-10, are used to fold large size press sheets including 16- and 32-page signatures, maps, and charts. In addition to the folding units, large folders are often equipped with attachments for trimming, perforating, scoring, and pasting of the sheets. These operations can be done quickly and simply in one pass through the folder.

Smaller print shops, including most shipboard shops, have less demand for folding work. In many cases, their folding workload can be handled by hand or by the use of smaller table top folding machines as shown in fig. 16-17.

Figure 16-11 shows the types of folds that can be made on a folding machine. Parallel folds consist of one or more folds in the same direction and right angle folds consist of two or more folds in different directions. Only one folding unit is required to produce parallel folds, but the machine must have two folding units if it is to produce right angle folds. If it has only one folding unit, after the sheets have been folded once, they must be run through the folder a second time to produce the right-angle fold.

Types of Folders

There are two basic types of folding machines: knife folders and buckle folders. Both types produce the fold by forcing the paper between rollers, as shown in figures 16-12 and 16-13. The buckle folders are more versatile and are the type you will operate in the Navy.

Large Folding Machines

Large folding machines consist essentially of a feeder, a conveyor or register table similar to the feedtable on an offset press, one or more folding units, and a delivery unit. (See fig. 16-10.)

Feeder Units

There are three types of feeder units found on folding machines: friction, pile, and continuous.

On the machines equipped with the friction feeders the stock is fanned out and placed in an inclined feed tray. Gravity moves the leading edge of the top sheet of the fanned-out pile against a rotating rubber wheel, which forces the sheet onto a register table. Moving conveyor tapes or rollers then carry the sheet down the table to the folding unit. Some friction-fed folders have only one folding unit and can produce only simple parallel folds; others have two units and can produce both parallel and right angle folds. The sheets come out of the folding unit folded and ready for packaging.

You can load the friction-type feeder while the folder is in operation by inserting a fanned-out lift under the stock being fed.

The pile feeder, shown in figure 16-10 is similar in many respects to the feeder on the offset press. The paper is loaded onto an elevating platform that raises automatically as the sheets are fed into the machine. A pile height governor regulates the height of the stack and also helps to control the sheets as they are floated by the blast of air from the blow pipe at the front of the pile. A revolving suction wheel picks up the top sheet from the stack and forces it under a set of rubber rollers and a caliper onto the register table. If more than one sheet passes under the caliper, the caliper will bind and trip off the suction to stop the sheets from feeding.

Since the movement of the side guide on the register table is limited, the stock is generally aligned with the side guide, and this means that the sheets are generally positioned on the left side of the feed table, rather than centered on it.

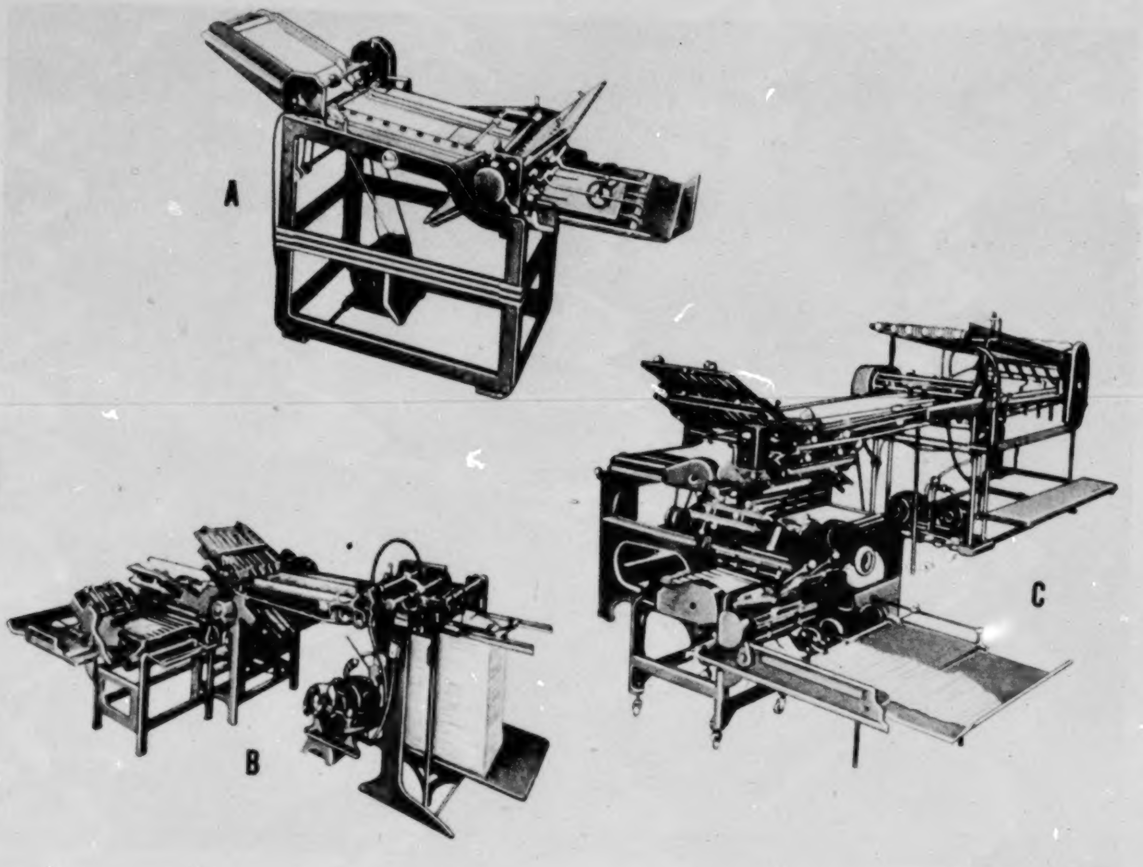
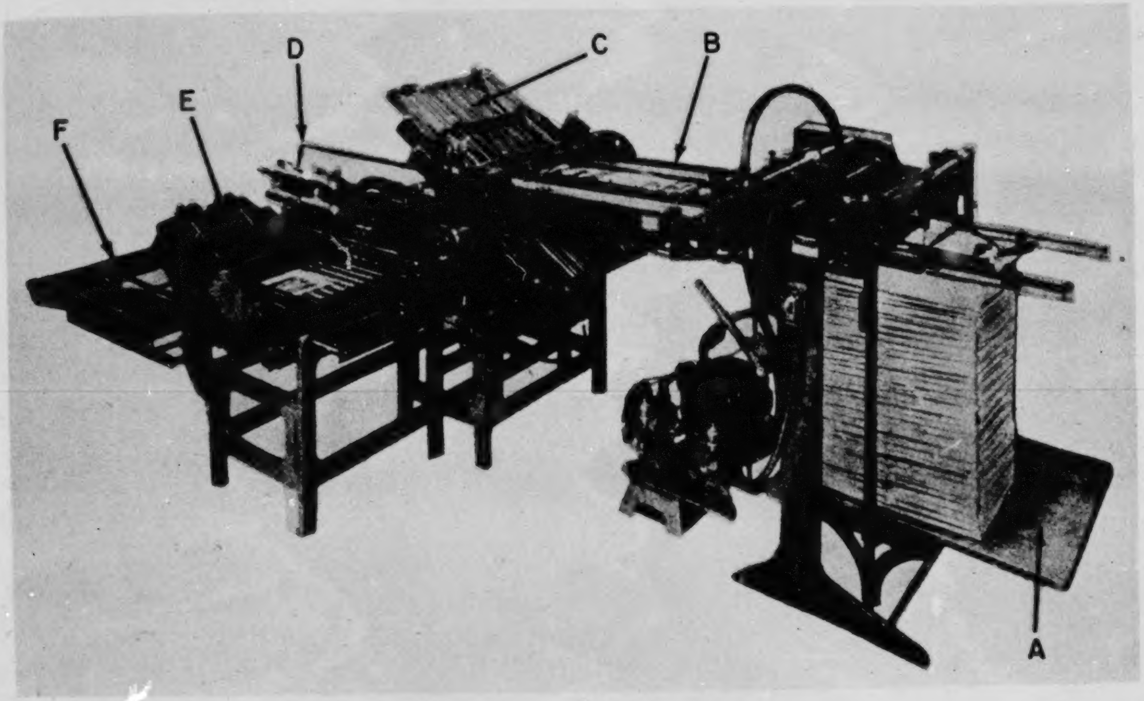


Figure 16-9.–Three types of folders: A. Friction feed; B. Pile feed; and C. Continuous feed. 57.462X

The continuous feeder, shown in figure 16-9, has the same features for separating and feeding the stock as the pile feeder, but the stock must be loaded into it in a different manner. You must stop the feeder to load the pile feeder, but the continuous feeder can be loaded while the machine is running. The operator simply places a hundred or more sheets on the top loading board, fanning them out to start the sheet separation. Conveyor tapes then carry the sheets down from the second-story loading board, in a continuous stream to a suction wheel which separates the sheets and forces them onto the register table one at a time. The signatures must be loaded upside down on this type of feeder in order to be in the correct position when they reach the suction wheel.

Register Table

The register table is similar to the feedboard on the offset press. It is equipped with a series of conveyor tapes or steel rollers which run diagonally to carry the sheet to the left against a side guide equipped with a series of glass or metal balls. These balls help control the speed and registration of the sheet as it travels down the register table. There are also various hold-down rods and paper guides which aid in controlling the sheet.



57.461X

A. Feeder
B. Register Table
C. First Fold Unit

D. Second Fold Unit
E. Third Fold Unit
F. Delivery Unit

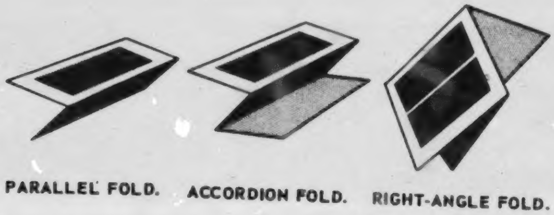
Figure 16-10.—Major components of a large pile fed folding machine.

Folding Unit

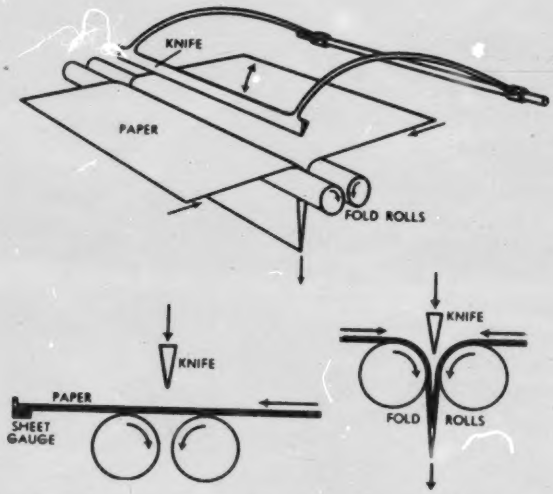
At the end of the register table, the sheet passes between two rollers which force it into a metal chute called a fold plate. The sheet travels up the chute until it is stopped by a metal bar known as the fold plate stop. Since it can go no farther, it buckles and passes through the folding rollers below. These rollers crease the sheet to complete the fold and also force it to travel on. The fold plate stop is adjustable and you can raise or lower it to regulate the distance the sheet travels up the chute, thus controlling the width of the fold.

The adjustment of the rollers in the folding unit is very important. If they are too loose or if they have more pressure at one end than at the other, they will allow the paper to slip and the fold will be crooked. The roller pressure is varied according to the type of stock being run. A heavy stock folded against the grain generally requires more pressure than light stock.

If the sheets are small and the stock is not too thick, the rollers in all folding units can be set for constant pressure (in contact with one another). But if the sheets are fairly thick and bulky after they have been folded in the first folding unit the rollers in the second and third



57.458
Figure 16-11.–Types of folds. Parallel folds consist of one or more folds in the same direction. Right angle folds consist of two or more folds in different directions. An accordion fold is generally used on maps and charts.



Reprinted by courtesy of Colton Press, Inc., publishers of Graphic Arts Production Yearbook, copyright 1947.

57.459X
Figure 16-12.–How the knife folder operates. Compare its operation to the roller folder.

folding units should be set for suspended pressure (separated by a distance equal to the thickness of the folded signature) to prevent excessive bounce and wrinkling and splitting of the stock.

Deflectors

If another fold is to be made in the same direction, after the sheet leaves the first fold plate it passes into a second fold plate where another fold is made. But if no other folds are to be made in this direction, the openings in the subsequent fold plates are covered with metal bars, called deflectors. The deflectors prevent the sheet from entering the fold plates, and the sheet passes through the remaining rollers without being buckled or folded.

After the sheet leaves the first folding section it travels on to the next folding section for additional folds (or if no more folds are required, out to the delivery unit).

Cross Carriers

If a right-angle fold is required, as the sheet comes out of the first folding section, it travels onto a series of metal rollers called cross carriers. They carry it against another side guide which consists of two revolving wheels. These wheels change the direction of the sheet and force it into the second folding unit.

Another type of cross carrier, consisting of a powered roller set at a 90° angle to the first folding section, is shown in fig. 16-14. In this type of carrier, the inertia of the sheet being ejected from the first unit forces the sheet under a set of hold-down marbles and against a side guide. The side guide and marbles register and control the sheet as it is carried to the next fold unit by the cross carrier rollers.

Scoring

Naturally, after 2 or 3 parallel folds have been made, it is hard to fold a large, bulky sheet in the other direction. Therefore, when right-angle folds are required, the sheet is generally scored with scoring wheels which break the stock where the crease is to go. Work may be scored as it comes out of any of the folding units. Perforating and cutting blades may also be used at any of these points instead of the scoring wheels. (See fig. 16-15.)

If more folds are necessary after the sheet leaves the second folding unit, it is run over

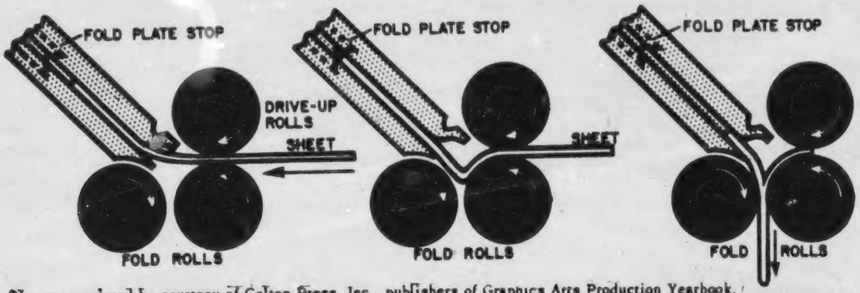
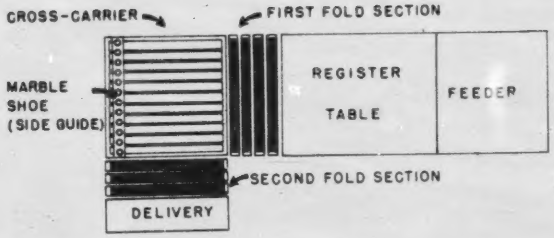


Diagram reprinted by courtesy of Colton Press, Inc., publishers of Graphics Arts Production Yearbook, Copyright 1947.

57.460

Figure 16-13.—How the roller folder operates.



57.468

Figure 16-14.—Diagram of a folder having cross carriers at a 90° angle to the first fold unit.

another set of cross-carriers into a third folding unit. The sheet finally emerges from the folding unit onto a moving canvas belt in the delivery unit (stacker).

Stacker

On most folders, the stacker is interchangeable with the cross carrier sections. You can remove the cross carrier and attach the stacker in its place at any point where no more folds are required. If the sheet requires only a single or parallel fold, the operator generally places the stacker after the first folding unit. If right-angle folds are necessary, he may place it after the second folding unit, and so on. Thus the sheet does not have to travel through the entire machine, when only simple folds are required.

Folding Impositions

The imposition, or arrangement, of the pages on the signature is highly important. It must be planned before the job is printed. The stripper should consult the binderyman before he prepares his flats in order to avoid a slip-up that might necessitate time-consuming hand folding.

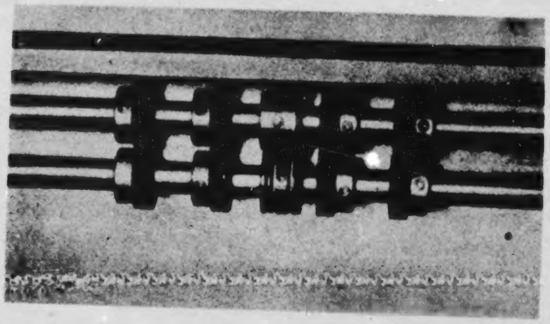
The imposition must be planned so that the pages will be in their proper order after the signature is folded. Figure 16-16 shows some of the different impositions that can be used for the folding machine. This chart is only intended as a guide, however, and you will find that many of these impositions can be varied or folded in a different manner.

TABLE TOP FOLDING MACHINES

Shown in fig. 16-17 is a 17″ X 22″ table top folder manufactured by the Challenge Machinery Co. This machine is similar in operation and set-up to the smaller, compact folders you will find aboard ship. It is friction fed and can handle single or double parallel folds. It also can slit, score, or perforate the sheets by the addition of special attachments.

Feeder Setup

When loading stock on the paper platform you can place a stack of approximately 50 sheets under the feed cap (G) or you can place a



57.469X

Figure 16-15.–Scoring wheels may be located on either the upper or lower shafts, depending upon which way the sheet is folded.

larger lift under the feed cap by fanning the stack so that the top-most sheets overhang the others and will be caught and fed into the machine one sheet at a time in the manner shown in figure 16-18. An extension bar is provided for use when the fanned stack is too long for the platform.

Center the paper on the platform; then loosen the posts (B) shown in figure 16-17, and move the paper guides (A) up against the pile and lock them in place.

The rubber feed roller (A) shown in figure 16-18 acts as a caliper for the stock preventing more than one sheet at a time from being fed into the machine. To set it, raise the feed cap and slip a sheet of the stock to be folded underneath the roller. Then adjust with screw (B) shown in figure 16-17. A clockwise turn of the screw increases the pressure and vice versa. Adjust until the sheet is held with a very slight pressure.

Fold Plates

This machine has two fold plates. The upper fold plate is longer than the bottom one. If only one fold is required, you can turn the fold selector knob on the far side of the machine to prevent the paper from going into the lower fold plate. You can also remove the upper fold plate from the machine and place the No-Fold Deflector Plate shown in figure 16-19 in its place. When this is done, only the bottom fold plate will be in use. If you wish to run the paper through without folding it, as when you are perforating the sheets, place the deflector plate in the machine and turn the fold selector knob to prevent the paper from entering the lower fold plate.

To install the fold plates push them in along the slides provided until they catch and are held firm. To remove, raise them slightly and pull out.

You can set the fold plates for the width of the fold by loosening the screws (E) shown in figure 16-19 and moving the fold plate stop manually until it is at the correct position on the scale provided on the front of the fold plate. The knob (F) is for making minute adjustments. Most operators remove the bottom fold plate from the machine when setting it. On some machines you can set the fold plate stop at a slight angle, if necessary, when the sheets are not cut true.

First Roller Pressure Adjustment

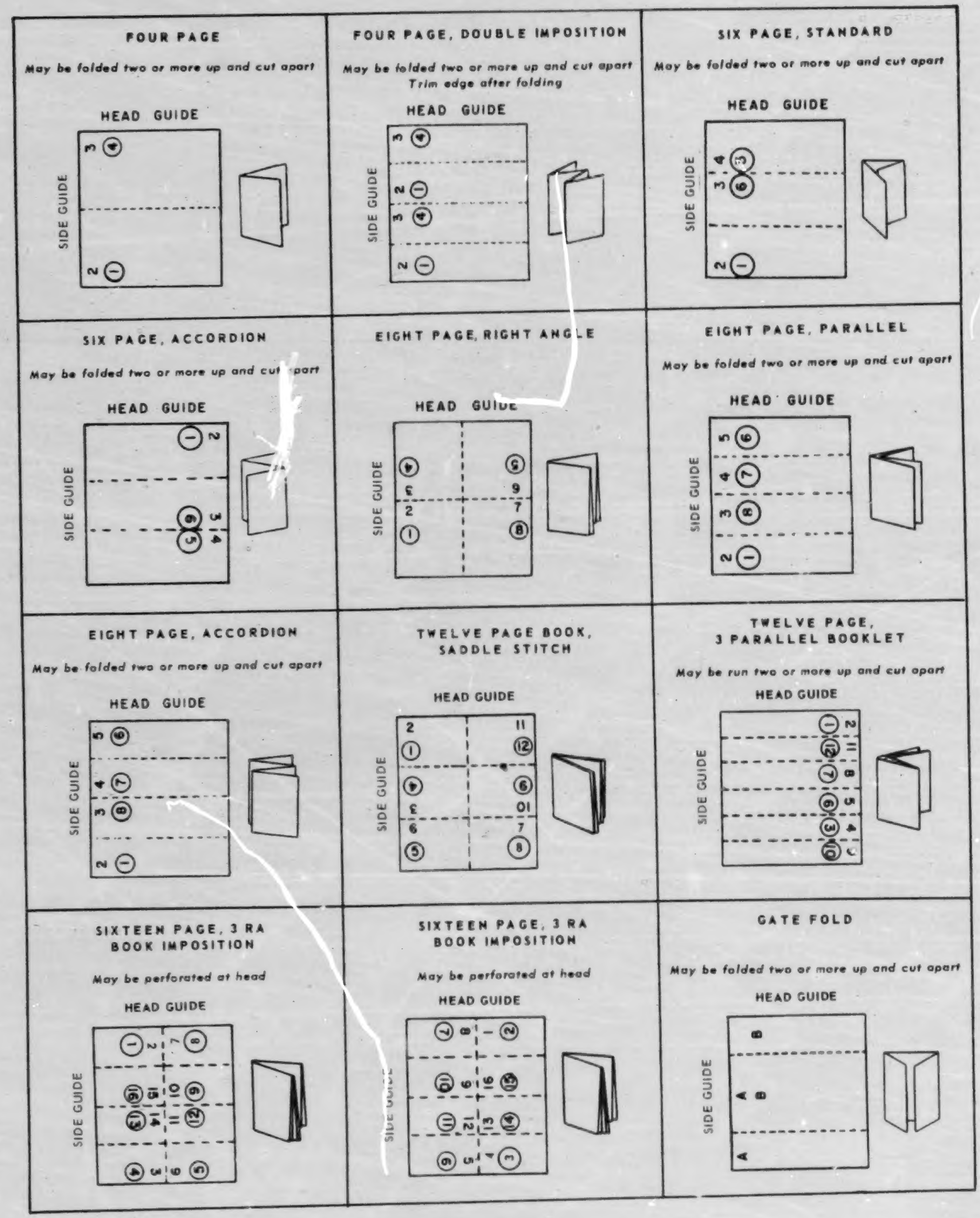
You can adjust tension on the first metal roller to accommodate stock of varying thicknesses or to cause one side of the paper to enter the first fold plate faster than the other, thus allowing for badly cut sheets.

No adjustment is necessary for most paper stocks, but for thin paper, which has a tendency to wrinkle, you should turn the knobs (D) shown in fig. 16-19 clockwise to release the tension on the first roller. Turn the knobs in the opposite direction to accommodate heavy stock or extremely smooth coated stock.

Stacker Controls

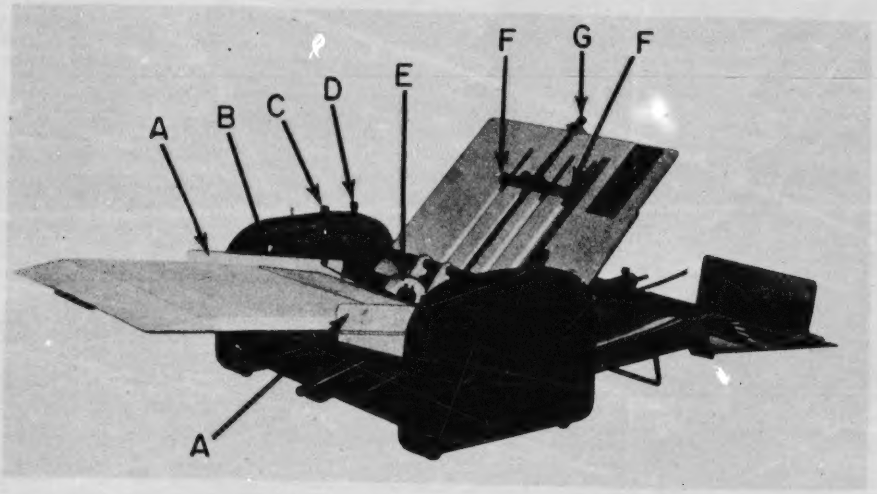
Figure 16-20 shows the stacker controls. As the folded sheets emerge from the machine, they are carried by two rubber conveyor belts under the stop wheels (A) and finally out to a receiving tray where they are stacked until they can be removed from the machine.

You can move the stop wheels forward or backward along the rod to which they are attached. They should be set to rest on the front edge of the folded sheet as it comes out of the folding unit. The counterweight (B) can also be


FOUR PAGE
May be folded two or more up and cut apart
HEAD GUIDE
SIDE GUIDE
FOUR PAGE, DOUBLE IMPOSITION
May be folded two or more up and cut apart
Trim edge after folding
HEAD GUIDE
SIDE GUIDE
SIX PAGE, STANDARD
May be folded two or more up and cut apart
HEAD GUIDE
SIDE GUIDE
SIX PAGE, ACCORDION
May be folded two or more up and cut apart
HEAD GUIDE
SIDE GUIDE
EIGHT PAGE, RIGHT ANGLE
HEAD GUIDE
SIDE GUIDE
EIGHT PAGE, PARALLEL
May be folded two or more up and cut apart
HEAD GUIDE
SIDE GUIDE
EIGHT PAGE, ACCORDION
May be folded two or more up and cut apart
HEAD GUIDE
SIDE GUIDE
TWELVE PAGE BOOK, SADDLE STITCH
HEAD GUIDE
SIDE GUIDE
TWELVE PAGE, 3 PARALLEL BOOKLET
May be run two or more up and cut apart
HEAD GUIDE
SIDE GUIDE
SIXTEEN PAGE, 3 RA BOOK IMPOSITION
May be perforated at head
HEAD GUIDE
SIDE GUIDE
SIXTEEN PAGE, 3 RA BOOK IMPOSITION
May be perforated at head
HEAD GUIDE
SIDE GUIDE
GATE FOLD
May be folded two or more up and cut apart
HEAD GUIDE
SIDE GUIDE
A
B
A B

57.471X

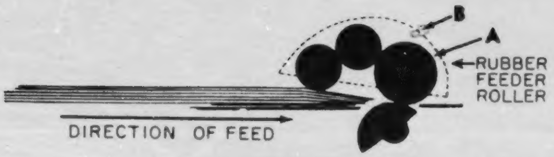
Figure 16-16.—Folding impositions.



57.761X

- A. Paper Guides (2)
- B. Posts (2)
- C. Feed Roller Adjusting Screw
- D. First Metal Roller Adjusting Screw
- E. Feed Cap
- F. Fold Plate Adjusting Screws (2)
- G. Minute Adjustment Knob for Fold Plate

Figure 16-17.—Table top folding machine.



57.664X

- A. Rubber Feed Roller Which Acts As A Caliper for the Stock.
- B. Feed Cap

Figure 16-18.—Load the stock into the feeder in this manner.

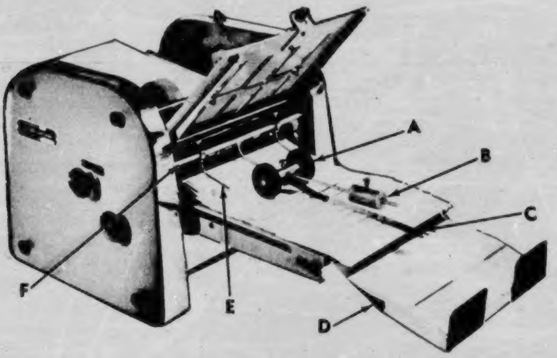
57.667X

Figure 16-19.—No-fold deflector plate.

moved forward or backward for different types of stock. Moving it away from the folding unit creates more pressure on the stop wheels and vice versa. The receiving tray simply hooks onto the conveyor table. You can remove or install it easily.

The paper depressors (E) should be adjusted to just clear the folded sheets as the paper emerges from the folding unit. You can remove the paper stack support rod (F) to which these depressors are attached by pushing in on it at the near side of the machine. This will release it at the far side and you can then remove it from the folder.

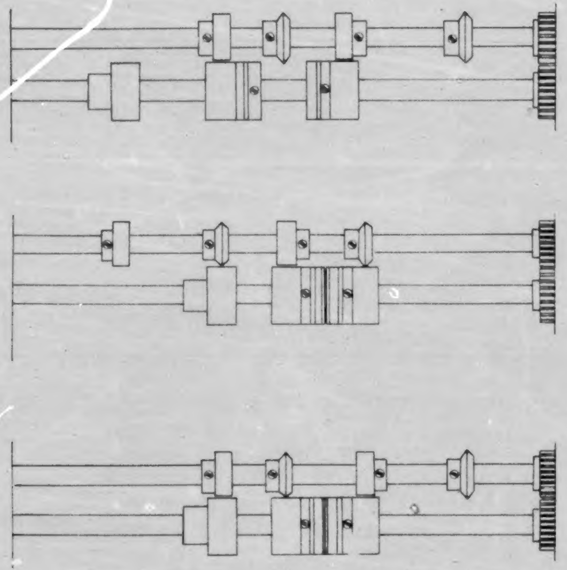
The rubber transportation rollers should be moved sidewise as necessary to accommodate different widths of stock. They are held in place with setscrews. Set them about 1/2″ in from the edges of the sheet.



A. Stop wheels.
B. Counterweight.
C. Metal hold down.
D. Receiving tray.
E. Paper depressor.
F. Paper stack support rod.

57.666X

Figure 16-20.—Stacker controls.



57.668-.670X

Figure 16-21.—Various scoring wheels arrangements.

Scoring, Slitting, Perforating

When the machine is to be used to score, slit, or perforate, you must add special wheels to the upper and lower transportation axles. These axles are located at the back of the machine in front of the receiving tray. Various wheel arrangements are shown in fig. 16-21.

Removing the Transportation Axles

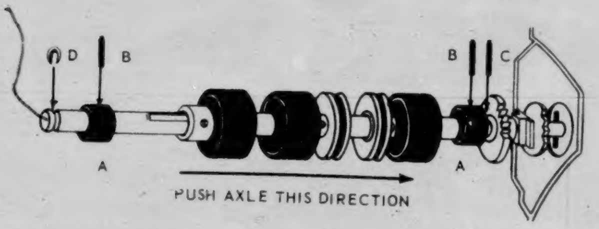
To remove the upper transportation axle when adding scoring wheels, slitters, or perforators, raise it until the bearing lock snaps into place under the bronze bearing. Then loosen the setscrew and move the bushing out of the bearing toward the center of the machine. Push the entire shaft into the bearing and you will find it simple to remove the shaft from the machine.

To add additional lower transportation rollers, slitting wheels or perforating wheels to the lower transportation axle, remove clip (D) shown in figure 16-22 and tap out pins (B) from the eccentrics (A). Loosen the setscrews in all transportation rollers or wheels. Push the axle to the right out of the side frame far enough to enable you to remove the eccentric rollers or gears. Do not push the axle entirely out of the machine. When replacing the eccentrics, be sure that their high sections are on opposite sides of the axle so that the forks on the conveyor table can be activated.

GATHERING

Before a multipage job can be bound, it is assembled in correct sequence. This procedure is known as gathering, although the term collating in recent years has come about to be used interchangeably with gathering. Collating correctly describes the process of checking gathered pages or signatures.

If the job is to be bound along the fold (saddle), the signatures must be inserted into one another in sequence. To gather folded signatures by hand, place the signatures in stacks



- A. Eccentric.
- B. Pin.
- C. Pin.
- D. Clip.

57.673X

Figure 16-22.—Loosening lower transportation axle.

on a table with the lowest numbered pages on the left. Then starting at the right side, pick up the signature on the top of the first stack and insert it in the fold of the signature from the top of the stack next to it. Continue this operation, working to the left until one signature has been taken from each stack. The completed units of assembled signatures are stacked in a crisscross pattern to keep them separated until they are stapled or stitched.

The procedure for assembling flat, unfolded sheets which are to be stitched along the edge is similar to the one just described, except that the pages are placed one on top of another instead of being inserted one into the other. You may work from the right to the left in both cases, and you should always criss-cross the gathered pages.

There are so many methods of gathering that it would be difficult to try to describe them all here. Some binderies are equipped with revolving round tables and you can simply sit before the table and pick up the sheets as the table rotates. There are also gathering racks, foot and power operated machines, and the time-tested method of picking up the sheets from the stacks as you walk around a table.

Many office forms are needed in duplicate or triplicate. These duplicate or triplicate forms are generally printed on different colors of stock and are frequently numbered. This means that the binderyman must assemble them in sets of the proper sequence before they can be padded, stitched or punched. As you can see in figure 16-23 these sheets are assembled in sets, in the same manner as you assemble the loose pages for a book that is to be side stitched except that they are stacked in a pile instead of being crisscrossed. When you have enough sets for a single pad or book (generally 25 sets of triplicate forms or 50 sets of duplicates) you should place a piece of chipboard on the pile and continue with the next pad or book. If forms are to be stapled or stitched instead of padded, the capacity of the stitching equipment will govern the number of sets that can be included in each book. In any case, you should try to work with multiples of 25 sets.

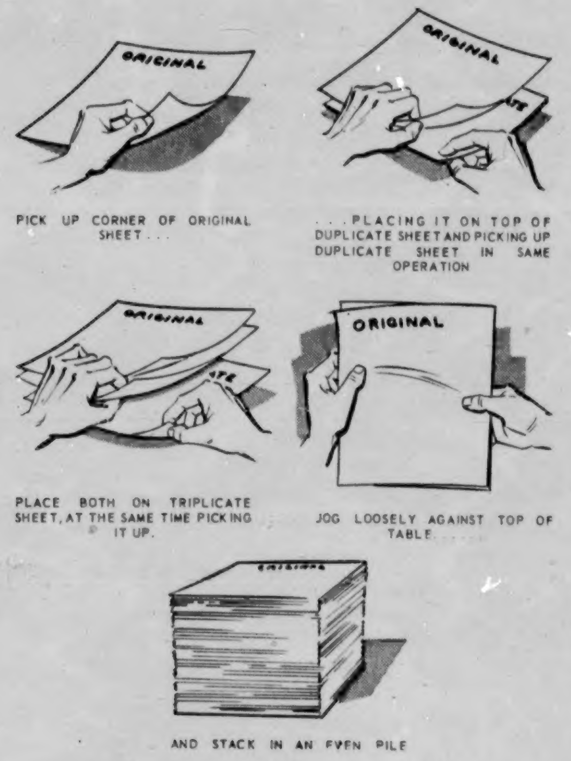
COLLATING

The process of checking the assembled book to see that all signatures have been included and that they are in proper sequence is known as collating. In the case of small pamphlets this may amount to nothing more than riffling through the pages of the assembled booklet. In the case of larger publications, a collating mark is usually printed in the gutter of each signature in such a position that it will appear along the outside fold (backbone) of the folded signature. The collating mark is dropped a uniform distance on each succeeding signature so that when all the signatures are gathered in the correct sequence, the collating marks will appear as a diagonal line down the spine of the book. (See fig. 16-24.)

This enables you to tell at a glance whether the signatures are in the correct sequence. Some shops print a numerical collating mark on the first page of each signature to aid in identifying and laying out the signature for gathering. (See fig. 16-25.)

PADDING AND BINDING

After the job has been properly assembled and trimmed on the cutter, it is ready for padding and binding. (Sometimes it is bound before it is trimmed, but this procedure is optional.)



PICK UP CORNER OF ORIGINAL SHEET . . .

. . . PLACING IT ON TOP OF DUPLICATE SHEET AND PICKING UP DUPLICATE SHEET IN SAME OPERATION

PLACE BOTH ON TRIPLICATE SHEET, AT THE SAME TIME PICKING IT UP.

JOG LOOSELY AGAINST TOP OF TABLE . . .

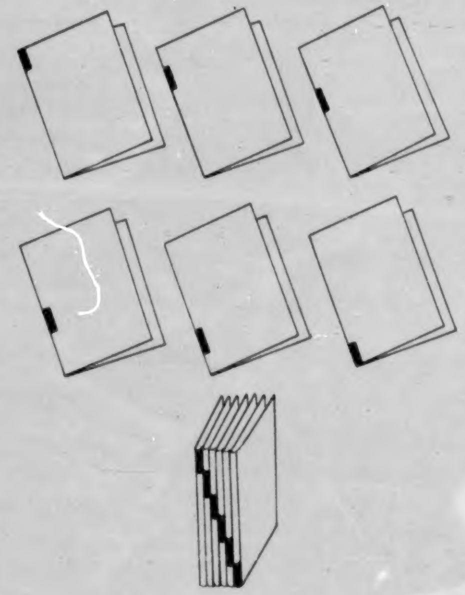
AND STACK IN AN EVEN PILE

57.476
Figure 16-23.—How to assemble triplicate forms.

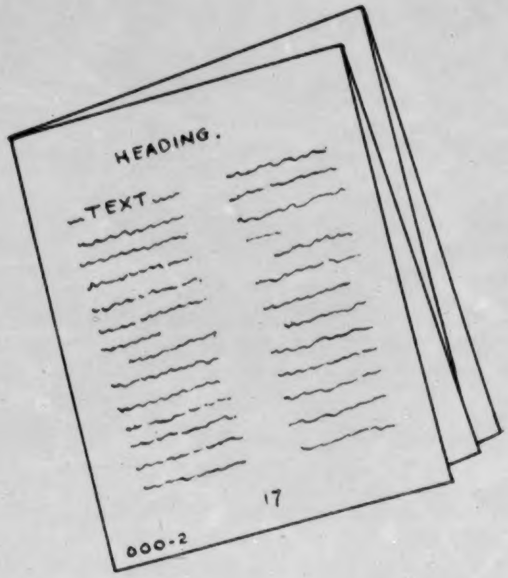
The type of binding done in the average print shop is not the same as that done in large binderies which specialize in that kind of work. Bookbinding is an art in itself. It has no place in the small job shop. Almost all print shops do the simpler forms of binding, such as stapling small books and pamphlets, however, and padding is a standard operation in any small print shop.

Padding

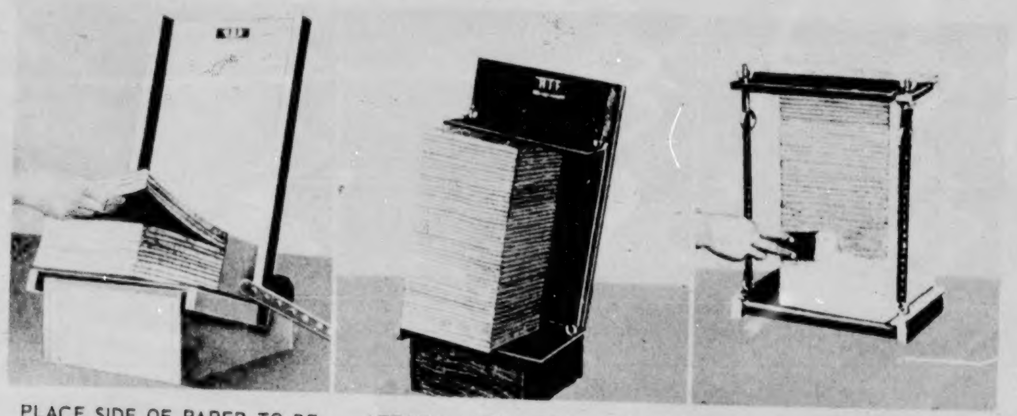
Padding is the process of making pads or tablets by cementing the edges of the stack of sheets. A pad generally consists of from 50 to 100 sheets of paper and a chipboard back. The paper is jogged as evenly as possible and stacked on a table or in a padding press, like the one shown in figure 16-26. You must always clamp the sheets or weight them down as as to force their edges together to form a smooth surface for the padding cement.



57.473
Figure 16-24.—Collating marks printed along the spine of each signature.



57.474
Figure 16-25.—Numerical collating mark on the first page of a signature.



PLACE SIDE OF PAPER TO BE PADDED AGAINST THE BACK OF THE ALIGNMENT BOARD.

ATTACH TOP BOARD AND APPLY NECESSARY PRESSURE WITH WING NUTS SUPPLIED.

REMOVE PRESSURE UNIT FROM STACKING RACK AND APPLY PADDING CEMENT.

57.475X

Figure 16-26.–Using a padding press.

The padding cement used aboard ship is a white, water soluble liquid with a thick, creamy appearance. It can be applied to the edges of the paper with an ordinary paint brush, as shown in the illustration. It dries within a few hours to form a flexible, rubbery substance that binds the pages together. One coat of cement is usually enough, but a second and even a third coating is sometimes applied to give the pad additional strength. Some operators add a piece of cheesecloth or thin gauze to the padded surfaces to ensure durability.

After the cement has dried, you can separate the pads by running a knife through the cemented surface, just beneath each sheet of chipboard backing. This will give you a group of individual pads, each with a cardboard back.

When it is not in use, the padding cement should be kept tightly stoppered, as air will ruin it in a very short time. The brush should be washed out with water each time it is used. It will eventually get clogged beyond use and you will have to discard it for a new one.

STAPLING AND WIRE STITCHING

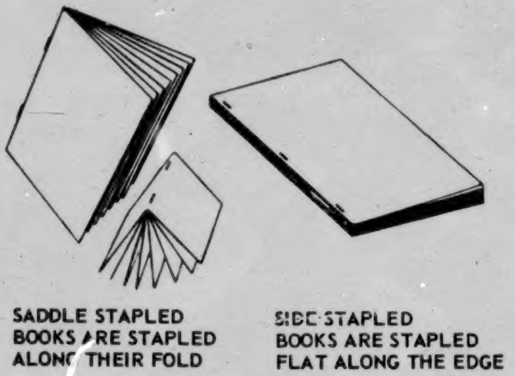
A common method of binding printed materials is to fasten them with staples. When the staples are formed from a spool of thin wire, instead of using preformed staples, the binding is referred to as wire stitching. Printed materials may be either saddle stapled along the fold or stapled along the side as shown in fig. 16-27.

Staplers

Foot staplers, like the one shown in figure 16-28, are often used for stapling small books and pamphlets. These staplers operate on the same principle as the ordinary hand stapler. The staples come in strips like the clip in a rifle, and they may be inserted in a magazine at the back of the machine. They are automatically pushed forward by a spring, and are separated and driven through the paper by the plunger when you step on the foot pedal.

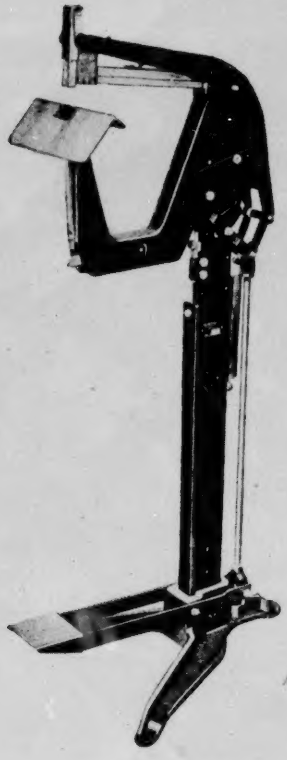
To saddle staple a book, you simply open it and place it straddling the stapler table (the house-top looking affair below the plunger). There are ordinarily no side guides on foot staplers. You must move the book to the approximate location where you want to staple it, then slide it along until it is in position for the next staple. Two or three staples are sufficient for most booklets.

If the book is to be side stapled, release the catch underneath the stapler table and raise it to a flat, horizontal position.



57.478

Figure 16-27.—Two methods of stapling.



57.477

Figure 16-28.—Foot stapler.

Wire Stitchers

Wire stitchers, similar to the one shown in fig. 16-29, are more versatile than staplers and are in wide use throughout the Navy. Wire stitchers are designed to handle either flat or saddle work in varying thicknesses from two sheets of paper to several hundred, depending on the type of stock. Most stitchers use either flat or round wire. Flat wire is recommended for thicker work.

As you have just learned, the staples in a stitcher are formed from a spool of wire. The wire is threaded from the spool down through the feeder mechanism which automatically advances the wire and forms a new staple each time the foot treadle is pushed. The length of the staples is adjusted for varying thicknesses of work by turning the handwheel, shown in fig. 16-29. To set the stitcher wire length, place a sample of the work in the thickness gage and turn the handwheel clockwise until the sample is firmly held in the gage. Next, turn the handwheel counterclockwise enough to allow you to remove the work sample. After the sample is removed, return the thickness gage to the point where it firmly held the work sample. If the work thickness gage is improperly set, staples like those shown in fig. 16-30 will be formed.

The stitcher work table is adjustable for either flat or saddle work. It is equipped with adjustable guides and stops for accurate positioning of the work.

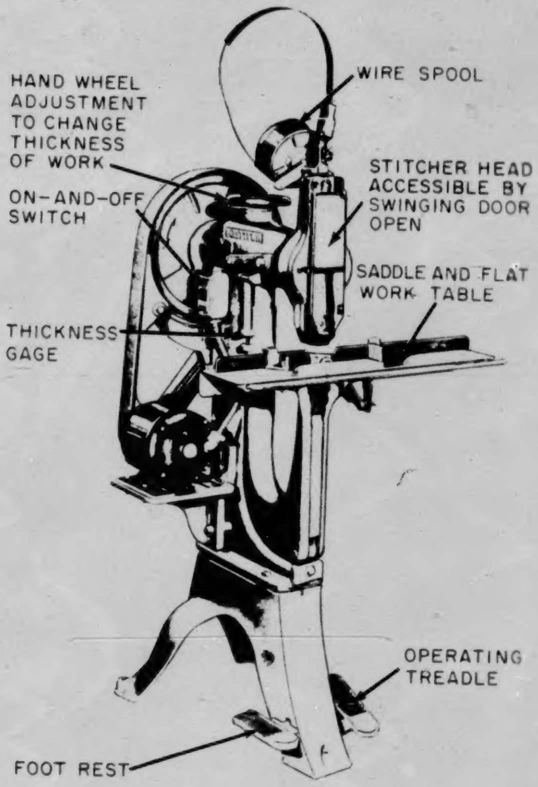
CAUTION

Do not touch the stitcher head when the power is on. Avoid injury to your fingers. Always secure the machine before putting your hands between the work table and stitcher head.

In shops with large bindery sections and shops that specialize in bindery work, you may find stitching equipment similar to that shown in fig. 16-31.

Plastic and Spiral Binding

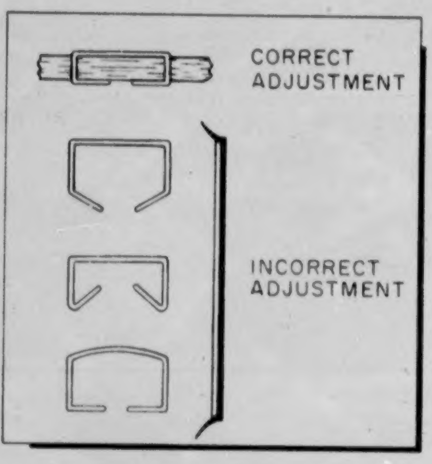
Shown in fig. 16-32 are two widely used types of binding. The spiral binding on the right


HAND WHEEL ADJUSTMENT TO CHANGE THICKNESS OF WORK
ON-AND-OFF SWITCH
THICKNESS GAGE
WIRE SPOOL
STITCHER HEAD ACCESSIBLE BY SWINGING DOOR OPEN
SADDLE AND FLAT WORK TABLE
OPERATING TREADLE
FOOT REST

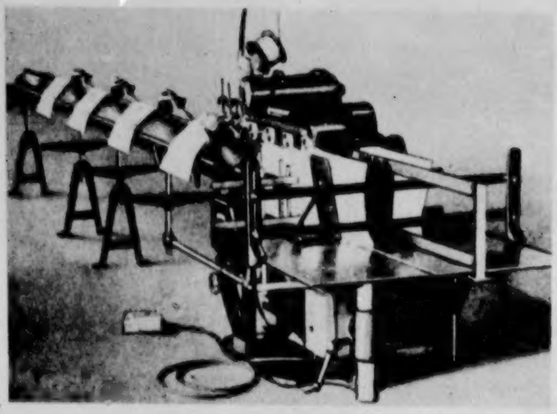
57.479X
Figure 16-29.—Wire stitcher.

originated in Europe. It is a patented process which requires the use of special bindery equipment. The job is printed and folded in the regular manner. Then it is trimmed on all four sides and punched. The wire, which is already in spiral form, is inserted by hand or by a machine and bent so that it will stay in place.

The plastic binding, shown at the left, is one of the most popular types of binding. You have probably seen it used on advertising literature and brochures. After the job is run and folded, the paper is trimmed on four sides as was described above. A series of rectangular holes is then punched in the paper along the edge to be bound. Then a roll of comb-like plastic is stretched and inserted into the holes. Plastic bindings are available in a wide variety of colors.

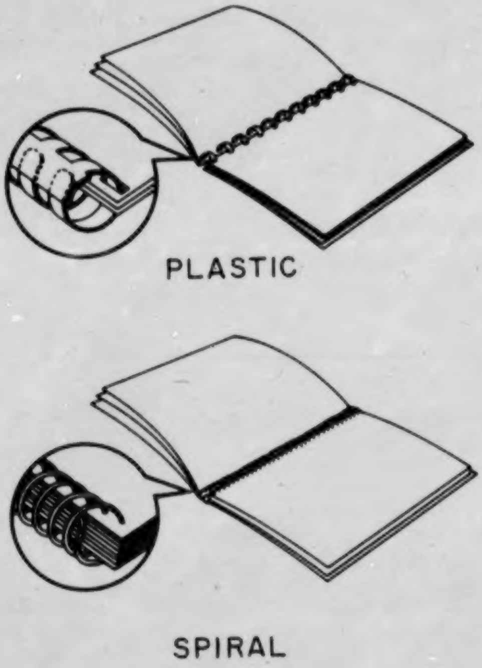

CORRECT ADJUSTMENT
INCORRECT ADJUSTMENT

57.762X
Figure 16-30.—Comparison of staples when the work thickness gage is improperly adjusted.

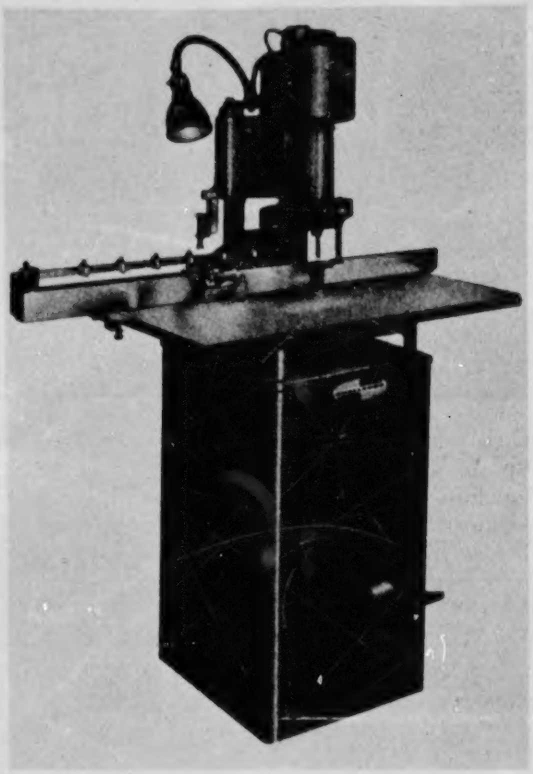


57.480X
Figure 16-31.—A large automatic stitcher machine.

The application of special bindings, such as the two just described is not a part of routine shop operations. Such work can be done only in a bindery equipped to handle it.



57.483(57C)
Figure 16-32.—Two types of specialized binding.

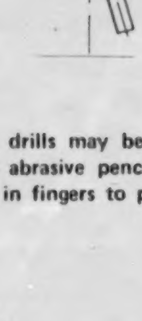


57.486(57C)X
Figure 16-33.—Paper drill.

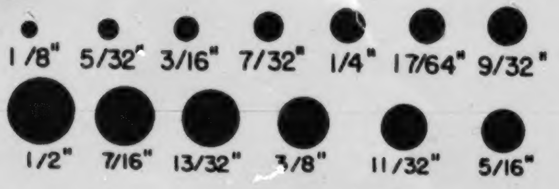
PAPER DRILL

Many shops are equipped with a paper drill similar to the one shown in fig. 16-33. The operation of such a drill is a relatively simple procedure. Holes are drilled in the paper when the foot treadle is depressed to bring a hollow, rotating drill through the stack of paper. A guide bar with adjustable stops is located on the drill table to space the holes accurately.

In addition to making conventional round holes, drills can be used to corner cut or to place V-slots or slits in the paper by the use of special attachments. If brown burn spots appear on the top sheets of paper when you drill through them, the drill is dull and needs to be sharpened. To sharpen a drill, an abrasive pencil is held against the rotating drill as shown in fig. 16-34. Many operators apply beeswax to the drill to reduce friction as it passes through the paper. Standard drill sizes are shown in fig. 16-35.

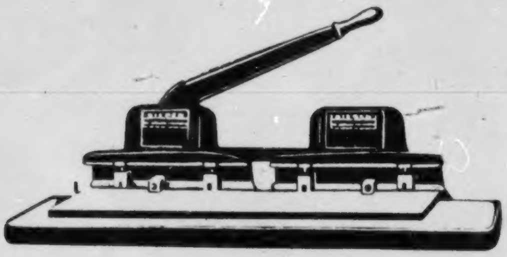


57.489X
Figure 16-34.—Paper drills may be sharpened in this manner. Hold the abrasive pencil at a slight angle. Rotate the pencil in fingers to provide a fresh surface to the drill.



57.490

Figure 16-35.—Standard drill sizes. (slightly reduced.)



57.484X

Figure 16-36.—Hand punch.

PUNCHING

Jobs which are to be bound in looseleaf binders are generally punched or drilled. This type of work is done on hand- or foot-powered punches or on drilling machines. Dies are available for producing the many unusual shapes required for various types of printing.

The Hand Punch

The hand punching machine, shown in figure 16-36, is ideal for the average punching job. Its operation is very simple after a few preliminary adjustments have been made.

You can move the dies sidewise until you reach the proper positions for the holes; then lock them in place with setscrews. Next, set the paper guide (A) on the left end of the machine to establish the proper location for your paper. The paper can then be inserted into the machine, a few sheets at a time, and you can punch it by lowering a hand lever or by stepping on a foot treadle.

WRAPPING AND PACKING

Letterheads and loose office forms are generally packaged in lots of 500 sheets unless otherwise specified.

Although wrapping paper comes in rolls of varying widths 24- or 36-inch widths are best for wrapping purposes. Tear off a sheet about double the length of the job to be wrapped. Wrap the paper around the width of the printed sheets and fasten it in place with a piece of Kraft (brown) water tape. Tuck in the ends, turn the top flap down and the bottom flap up; and then tape across them with a long strip of the water tape. Turn the package and repeat this process at the other end.

A sheet of 17" X 22" sulphite bond is exactly the right size for wrapping one ream of Navy standard 8" X 10 1/2" stock. You may find this paper more practicable than Kraft wrapping paper for this purpose.

Loose cards should be banded in lots of 100 or 200 to prevent the stack from falling apart in the package. Cut a narrow band from a piece of wrapping paper. Wrap it around the cards and fasten it with a piece of water tape. After all the cards have been banded, wrap them in a package. When envelopes and cards come in boxes, printers do not wrap them. They simply replace them in the box and tie the box with a piece of string.

Pads or books may be wrapped in lots of 5 to 10 per package, depending on their size. Packages containing office forms or forms which are to be stored for any length of time should be marked in some way so that you can tell what is inside without opening the package. You should attach one of the printed sheets to the outside of each package to show its contents.

CHAPTER 17

LETTERPRESS PRINTING

OFFSET VS LETTERPRESS

It is easy to start an argument concerning the respective merits of offset and letterpress printing. Yet most men will agree that each type of printing has its place and that it is possible to turn out good work by either process. The real difference lies in the kind of equipment needed and the kind of job to be done.

Most newspapers use letterpress because it is simpler for mass production and standard makeup purposes. If there is little or no artwork involved, if the makeup is fairly simple, and if the press run is small, letterpress is best. In fact, due to the limitations of the offset press, letterpress is more practicable for a great many jobs.

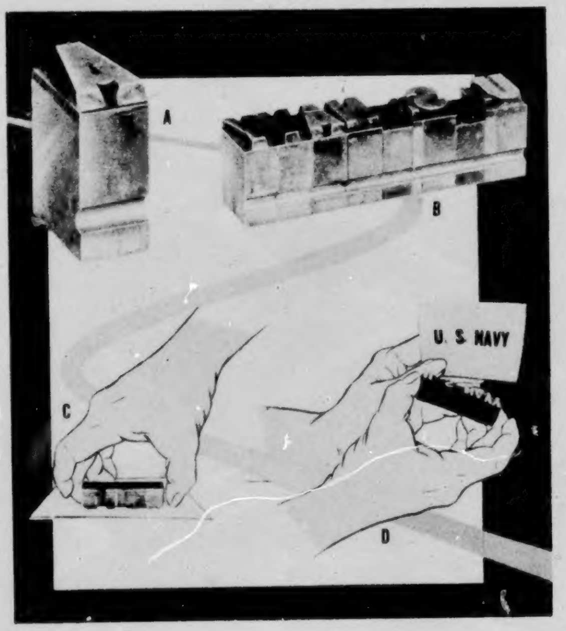
On the other hand, if a large number of illustrations are required, particularly on a small job, and if the job consists of rule forms or other work involving intricate makeup, offset is simpler and less expensive. Offset may also be used to advantage in the production of posters, calendars, maps, catalogs, and greeting cards.

But before you can decide which printing process is best for a particular job, you must know something of the fundamentals of each. You are already familiar with offset printing, of course, and this chapter will give you an overall picture of letter press operations.

TYPESETTING

Figures 17-1 through 17-5 show some of the equipment and operations involving in producing a letterpress job. Although type is often set by machine in large printing plants, handset type is still used for letterheads, cards, forms, and other types of "job" work.

A piece of the type used in handsetting is shown in figure 17-2. As you can see, it consists of a raised character cast on a metal shaft. The printer stores the type in a shallow drawer called a case. The case is divided into a number of compartments or boxes. There is a separate



A. A piece of type is simply a shaft of metal having a raised character (letter) cast on one end.

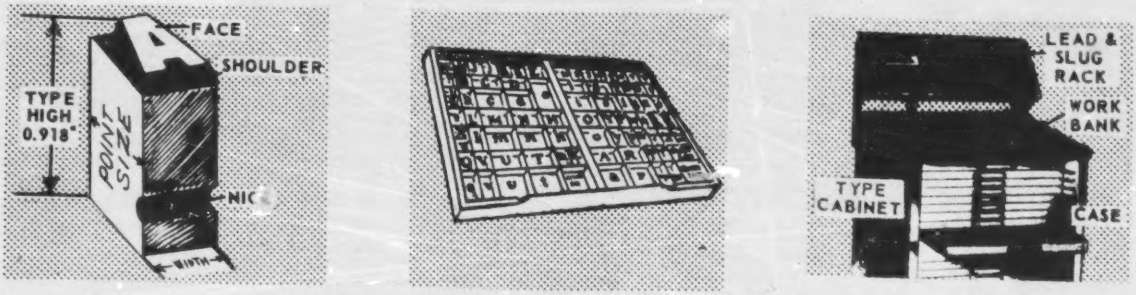
B. The different characters can be arranged in combinations to form words.

C. If these groups of raised letters are inked and pressed against a sheet of paper, they will leave a print or impression on the paper.

D. The spaces used between the words are shorter than the type and have no characters cast on the end. Consequently, they receive no ink and show up as white space on the paper.

57.10

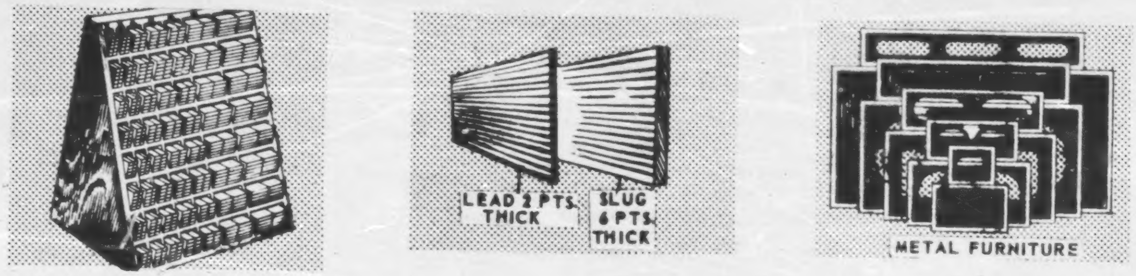
Figure 17-1.—How type is grouped to form words.



A piece of type. Type is sold in assortments called *fonts.*

The characters in the font are assorted and put into a case.

Cases are housed in a *type cabinet.* The slanted top of the cabinet is called the *work bank.* The *racks* above house *leads* and *slugs.*



Furniture is stored in racks like this. Wood furniture generally comes in 10–60 pica lengths and 2- to 12-pica widths.

Leads and slugs are used for spacing between the lines of type. Most leads are 2 points thick

Wood or metal furniture is used for spacing in large areas around the type and for locking it in the chase.

57.494

Figure 17-2.—Type and spacing materials.

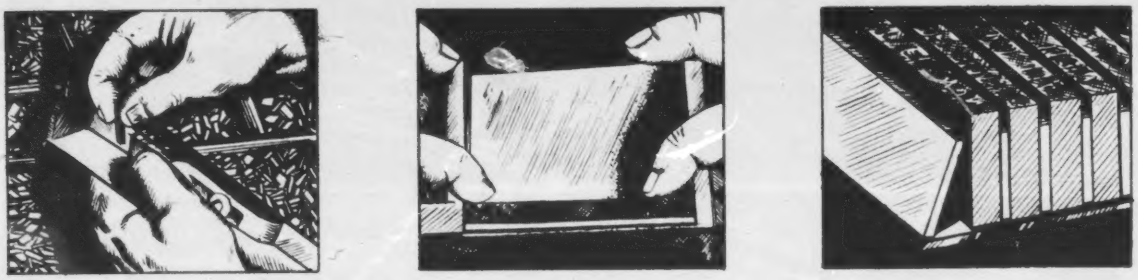
compartment for each group of letters, figures, spaces, or punctuation marks.

The man who sets the type is known as a compositor. He holds a three-sided metal device, called a stick, in his left hand; and he picks out the individual characters from the boxes in the case with his right hand. He arranges the letters in a line, as shown in figure 17-3. He separates each line from the next one with a thin strip of metal, called a lead; and he separates the words with blank pieces of type, called spaces.

Spaces are provided in a variety of sizes so that the compositor can justify the lines (make them all come out to the same length). If the line is so full that he cannot get the last letter of a word in a stick, he goes back and puts thinner spaces between the words in order to gain additional space. On the other hand, if the line is too short, he extends it by replacing the regular spaces with thicker ones.

When the stick is full, he slides the type onto a metal tray known as a galley. After all the type has been set, he places it in a press and pulls a proof. The proof is read and marked for errors. If errors are found, the type is corrected.

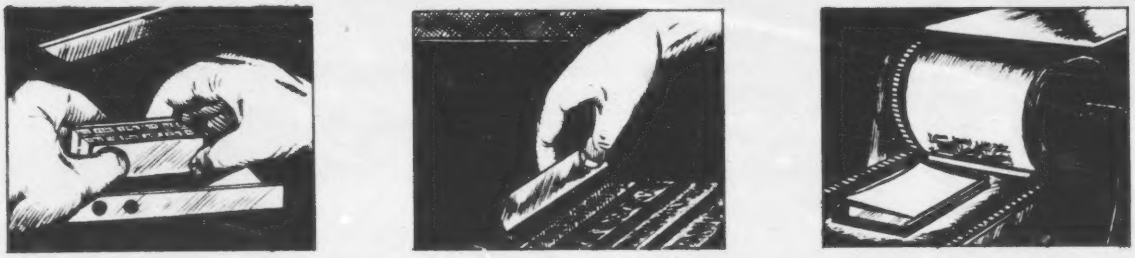
Then, if the job is to be printed by photo-offset, he pulls another proof (called a reproduction proof) from the corrected type. Reproduction proofs are just like other proofs except that they must be sharper and clearer. They are generally pulled on smooth, coated paper because this type of stock produces a better print. These proofs are sent to the cameraman who photographs them to produce the negatives for the offset plates.



The compositor picks out the individual letters from the [illegible] in the case and "sets" them in line in a metal device called the *stick*.

He uses *spaces* (blank pieces of type) to separate words and sentences, for spacing out lines, and for filling in blank areas.

Leads are used to separate the lines as the type is set.



When the stick is full, he slides the type out into a metal tray (*galley*).

If more spacing is required, he spaces out the type form and adds rules and borders in the galley. This is called *makeup*.

After the form is made up, he *ties* it and places the galley on a *proof press*. He pulls a proof which is read and marked for errors.

57.495

Figure 17-3.—Setting type.

It is not necessary to pull a reproduction proof if the job is to be printed letterpress. In this case, after the type has been corrected, the compositor slides it from the galley onto a metal composing table called the stone. (See fig. 17-4.)

There he positions the type in a metal frame, known as a chase, and builds around it with metal or wooden blocks called furniture. Finally, he "locks" it with small wedge-like devices called quoins. This prevents the type and furniture from falling out when he lifts the chase. When the type form is securely locked, he clamps the chase on the bed of the press and is ready to start production. (See fig. 17-4.)

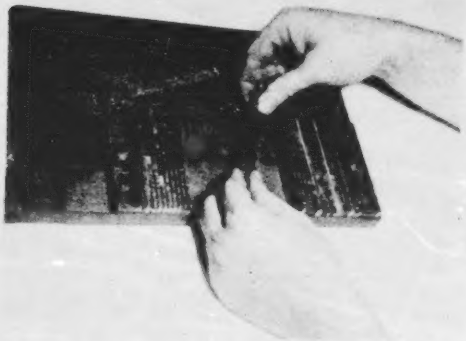
After the run, if the type is no longer needed, he removes it from the chase and distributes it back into the case, as shown in figure 17-5.

Type Cases

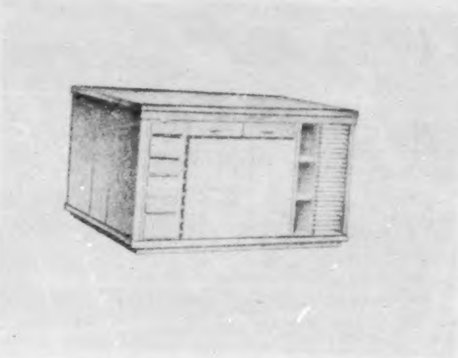
There are several kinds of cases, but if you know where the letters are located in one, you can easily find them in another. The California job case, shown in figure 17-6, is the most popular. It houses the lowercase letters on the left side and the capitals on the right.

You will notice that the lowercase letters are arranged not in alphabetical order, but by frequency of use. The "e," which is the most frequently used letter, occupies the largest compartment in the top center of the case while seldom used letters, like "j," "x," "z," and "q," are placed to the side in smaller boxes.

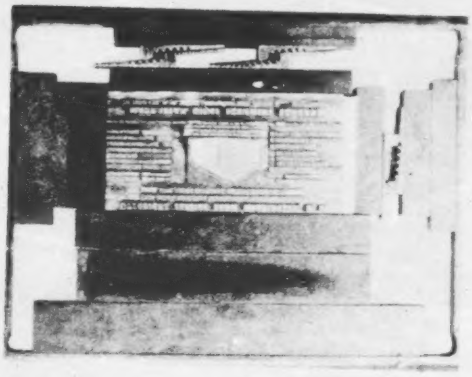
The capital letters are arranged in alphabetical order except for the "J" and "U." These letters



Simple errors are corrected in the galley. But if a correction affects the length of the line, the line must be respaced (justified) in the stick.

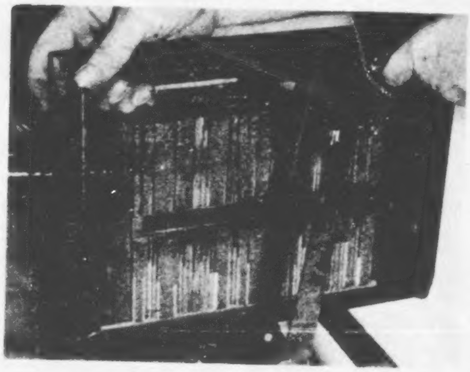


After the form has been corrected, it is slid off the galley onto a metal table, known as the stone.



A metal frame, known as the chase, is placed around the form and the type is blocked in with metal or wood furniture.

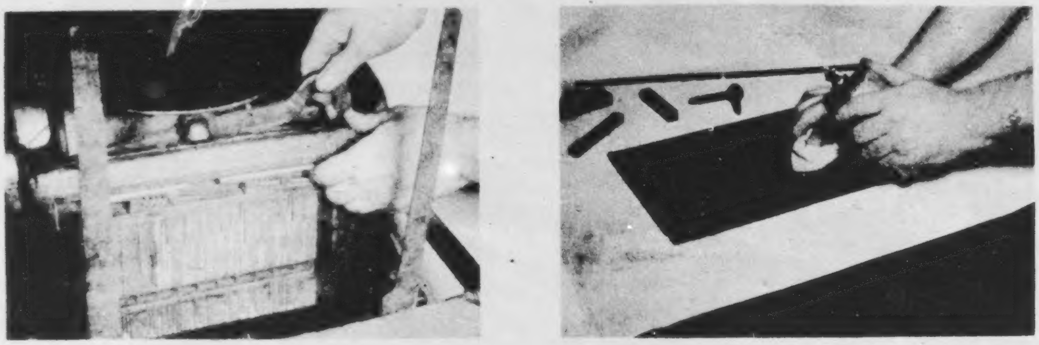
The operator tightens wedge-shaped devices called quoins to lock the form in the chase. He then checks it to see that nothing is loose.



As soon as the form is tight, he clamps the chase on the bed of the press.

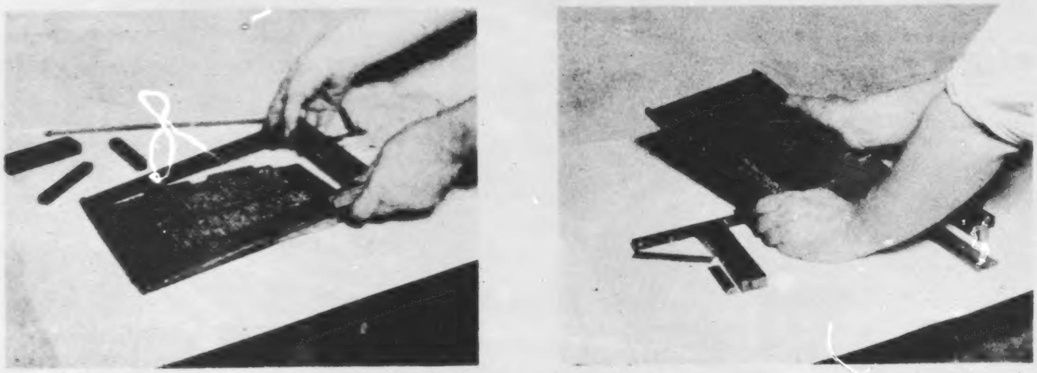
After a few preliminary (makeready) operations, he begins the run.

Figure 17-4.—Putting the form on the press. 57.496



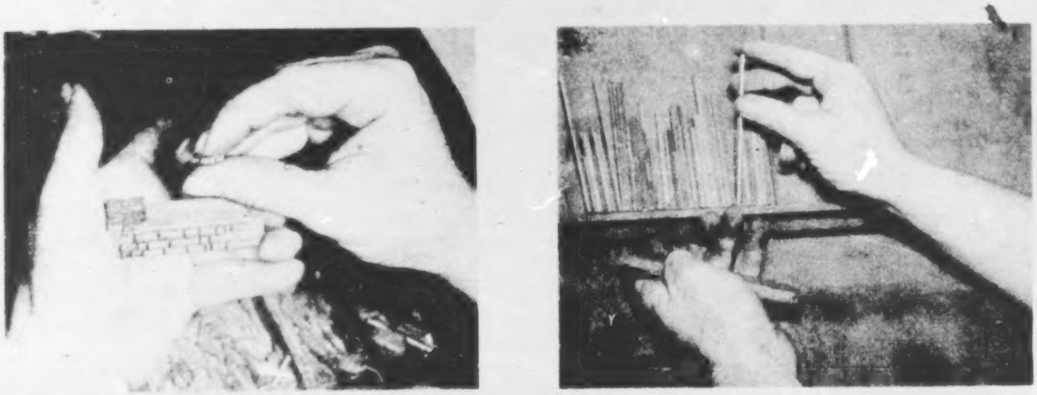
After the job is run, the form is removed from the press . . .

. . . and placed on a flat metal table (stone) where the type is cleaned.



The form is then unlocked and the chase and furniture removed.

The type is then transferred to a galley so that it can be moved conveniently.

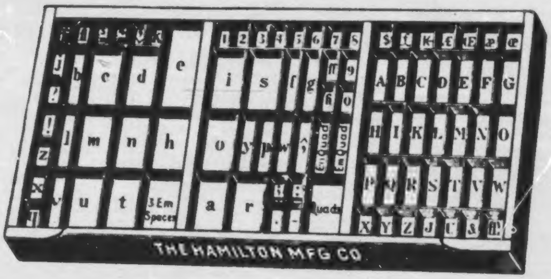


Later, the type is taken from the galley and put back into the proper boxes in the case.

Clean up operations follow. Leads and slugs are assorted for size and put back into the rack.

57.497

Figure 17-5.—Distributing the type back into the case.



57.498

Figure 17-6.—The California job case. There is a separate compartment for each letter, figure, and punctuation mark, as well as for the spaces. The best way to learn the locations of the letters in the case is to draw several diagrams of it and fill in on the diagrams where each letter goes. Continue this until you can do it from memory. Some beginners place such a diagram beside them on the case when they set the type and refer to it from time to time, as necessary, to locate seldom-used letters.

are out of place because the original Roman alphabet did not include them. When they were finally added to the alphabet, printers simply placed them at the end of the case.

Some cases also contain letters which have been combined, such as "ff," "fl," and "ffi." They are called ligatures and are used to save time and space in composition.

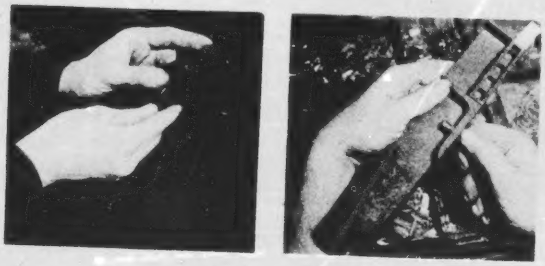
How to Set Type

In learning to set type, you must first memorize the case. Study the diagram shown in figure 17-6, until you know where each letter, punctuation mark, and figure is located. Then when you have the "lay" of the case fixed in your mind, you can begin setting the type in the stick.

One side of the stick is adjustable, and you can set this adjustable side (knee) to provide for any length of line. Figure 17-7 shows how this is done.

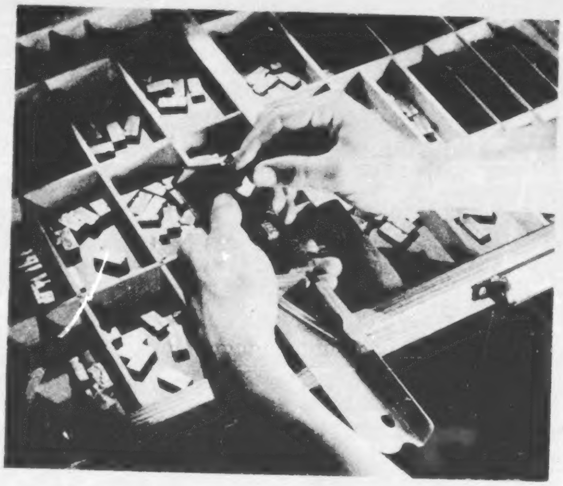
After you have set your stick for the length of the line, insert a slug (a strip of metal spacing material) in the stick, as shown in figures 17-8 and 17-10. You are then ready to set the first line.

Hold the stick in your left hand at a slight angle so the type will not fall out. Pick the letters from the boxes in the case with the thumb and first finger of your right hand and



57.499

Figure 17-7.—Two kinds of sticks. You can set the stick at left for the length of line by raising the clamp and moving the knee along the pica scale at the edge. The lever is for half-pica measurements. The stick is built to allow for squeeze. The stick on the right is set by locking the knee against metal furniture of the proper length. The slip of paper is to allow for squeeze. A properly justified line should be just slightly wider than the measure it represents.



57.500X

Figure 17-8.—Hold the stick in this manner. Always insert a slug before setting the first line. Type is placed in stick upside down, but words read from left to right, as in writing. Set type with face up and nick out. Use thumb to steady line.

insert them in the stick left-to-right, as shown in the illustration. Steady the line with the thumb of your left hand.

As you pick up each letter, twirl it between your fingers so that you place it in the stick with the face up and the nick out. Type is placed in the stick upside down, as you can see in the illustration, but the words are formed left-to-right, just as they are in writing.

You can use spaces to separate the words in the line and to space out the lines to the proper length. (Spaces are similar to type except that they are shorter and have no characters cast on them.) Each line must be spaced until it is held firmly in the stick.

Emptying the Stick

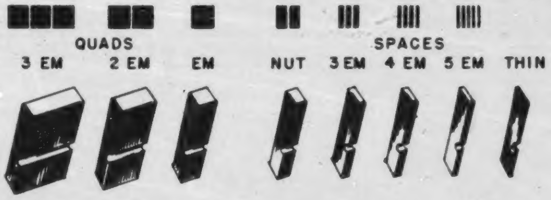
After you have set your first line and have spaced it properly, you should read it over to see if you have made any mistakes. If you have, correct them. If not, insert a lead in the stick and then set the next line. Follow this procedure until the stick is full.

When the stick is full, you must empty it in the galley. First see that there is a lead or slug outside the first and last lines in the stick. Then place the galley on the tilted work bank over the type cabinet and place the stick in the galley. Grasp the type between your thumbs and forefingers and bring the third finger of each hand against the sides so that the letters will not fall out as you slide the type from the stick.

If more type is to be set, set it and place it in the galley also. Do not unclamp the stick until the job is finished. If you unclamp it when removing the type, you may not get it set back to the same measure and the lines may vary in length.

Spacing Materials

Spacing materials are available for each size of type. The em quad, shown in figure 17-9, is a square space as wide as the point size of the type. (If you are using 8-point type, the em quad will be 8 points wide and 8 points thick, and if you are using 10-point type, the em quad will measure 10 points each way.) The em quad is the basic spacing unit. Figure 17-9 shows how it compares with the other units. The 2-em quad is twice as wide as the em quad, and the 3-em quad is three times as wide as the em.



57.501

Figure 17-9.—Spacing materials like these are available for each size of type.

Units smaller than the em quad are called spaces. The en (nut) space, shown in figure 17-9, is half the width of the em quad. The 3-em space is next in size and is equal to one third of the width of the em quad. The 4-em space is equal to one fourth of the em; and the 5-em space is equal to one fifth of an em. Thin spaces made of copper or brass are also available for each size of type. Brass spaces are one point thick and copper spaces are one-half point in thickness.

Quads are used for indentions at the beginning of paragraphs and for spacing out the last line in a paragraph. They are also used for spacing around centered headings and display lines. Spaces are used between words in sentences and headings. Quads and spaces are kept in the type cases.

Justifying the Lines

If you are setting type in paragraphs, you should use an em quad at the beginning of each paragraph, and use 3-em spaces between the words and sentences in it. Always space out or justify each line to the full width allowed by the stick. If you don't have room to get all of the last word in a line, you can:

1. hyphenate the word and carry part of it over to the next line, or
2. carry the entire word over to the next line and insert thicker spaces or combinations of thick and thin spaces between the words in the first line to fill it out to the proper length, or,
3. go back over the entire line and replace the 3-em spaces with thinner 4- or 5-em spaces to.

try to gain enough space to get the remainder of the word on the line.

If a line is too short–

1. see if you can fill it by adding a syllable from the next word in the copy. (This means that you will have to hyphenate the word and carry part of it over to the next line.) or
2. try spacing it out by using thicker spaces between the words.

Remember though, that good compositors always tend toward close rather than wide spacing between the words and sentences. Try to keep your spacing uniform. Don't space out a line by putting all the extra space between 1 or 2 words. Distribute the spacing evenly between all the words in the line. This same rule applies to stealing space from between the words.

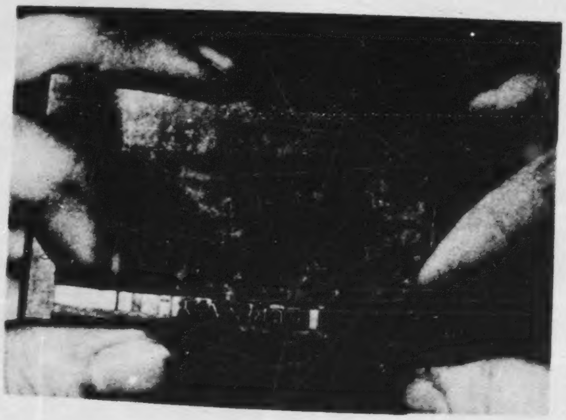
If you are unable to use the same spacing between all the words in the line, it is better to allow wider spacing between the words where one ends and the next one begins with a tall letter, such as "l" or "b."

It is not necessary to justify the last line in the paragraph, but you must fill it out with quads and spaces. Use the largest quads and spaces available, and keep the smallest spaces closest to the type.

You can use brass and copper spaces for hairline justification. Handle them carefully, as they are easily damaged. Figure 17-10 shows how to center a line by using the same number of spaces and quads on each side of the type.

Compositors sometimes place thin spaces between the letters of a word. This is known as letter-spacing. It makes short titles and headings appear longer.

Most compositors use a 2-point lead between the lines as they set the type. It is sometimes necessary to insert additional leads between lines or paragraphs to make the column come out to the required length. This is known as leading. Leading is generally done after the type is placed in the galley.



57.502

Figure 17-10.—To center a line, use the same number of spaces and quads on each side. The smallest quads and spaces are placed next to the type.

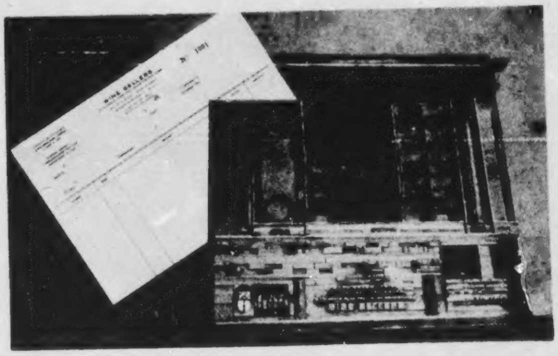
Makeup

After the type has been set and placed on the galley, you can space it out to the desired dimensions, place borders around it, and so on. Simple forms composed of lines of equal length may be simply spaced out to a desired length, or enclosed with rules or borders. More complicated forms, consisting of lines set on different measure, must be spaced out with metal furniture or other spacing materials so that each block of type is in the proper position before the form is locked for the press. Adding rules and borders and spacing out the type to its finished form is known as makeup. Figure 17-11 shows how metal furniture is used in making up a rule form.

Rules and Borders

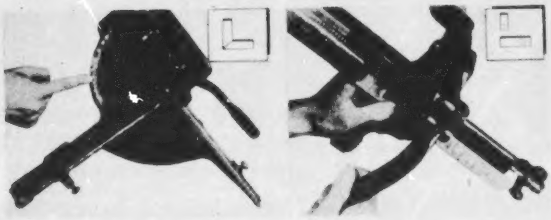
Rules and borders are type-high strips of metal which print as lines or patterns. There are two kinds of rules: metal and brass. Metal rules are cast from the same kind of metal as leads and slugs. And like leads and slugs, they are generally furnished in 2-foot strips and are then cut to order on a lead cutter, like that shown in figure 17-12, as they are needed.

Brass rules also come in 2-foot lengths, but they are generally supplied in ready-cut, labor-saving fonts. These fonts include lengths ranging from 1 to 36 picas. Rules and borders vary from 1 to 36 points in thickness.



57.503

Figure 17-11.—Rule form made up with metal furniture. Metal furniture is better than wood furniture for makeup purposes, since wood has a tendency to warp. Wood furniture is generally used for locking forms in the chase. Note numbering machine in lower left corner of form.



57.504X

Figure 17-12.—Left, a lead cutter. It is used for cutting leads and slugs and metal borders. Borders cut on it must be butted together, as shown in the inset. Right, a mitering machine. It produces a mitered joint. Do not cut brass rules on either of these machines.

Printers seldom place the type flush against the border. To keep the job from looking crowded, they usually allow 6 points (or more) space between the border and the type.

When setting a job that is to be enclosed with a border, you should cut your borders to the overall dimensions of the job. Then subtract the thickness of the side borders and spacing material to find the width to set your type. Figure 17-13 shows how to place a border around a job, and figure 17-14 shows how to make up a ruled table.

Typing the Form

After the form has been made up, you should tie it by wrapping 4 or 5 thicknesses of string around it. Tuck in the string at the end, and allow it to project slightly, as shown in figure 17-15. You can then untie it later by simply pulling up on the loose end.

Proofing

Once the form is tied, you should place it on the bed of a proof press and pull a set of proofs. Figure 17-16 shows a proof press. To operate it, you ink the form with a small hand roller, place a sheet of paper over the type and then run a cylinder or metal roller over the form. Remove the type before returning the cylinder to its original position.

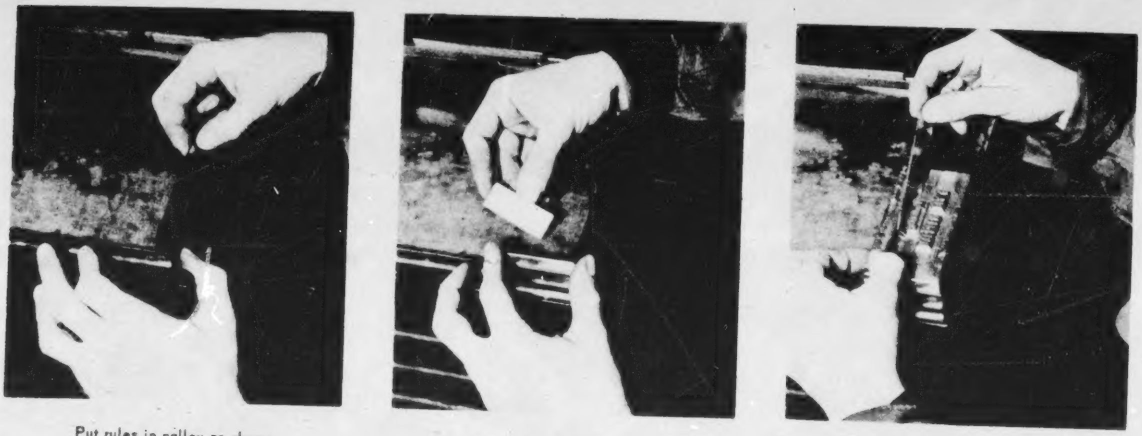
If you are aboard ship, the chances are that your shop will not have a proof press. In this case, you must pull your proof on the platen press. You will learn how to lock the form and put it on the platen press later in this chapter.

Correcting the Errors

If necessary, you can read your own proofs, but it is always easier to read them with another person. One of you can read aloud from the copy while the other marks the proofs. Memorize the set of proofreader's marks given in chapter 3 so that you can mark your proof properly.

If someone else reads the proof, you can clean the type while the proof is being read. You must wash the type each time you take a proof. If you allow the ink to dry on it, the letters will fill in and print dark and ragged. You can use a brush or soft rag moistened with type wash, or a similar solvent for cleaning type. Too much solvent will wash the ink between the letters and make them sticky.

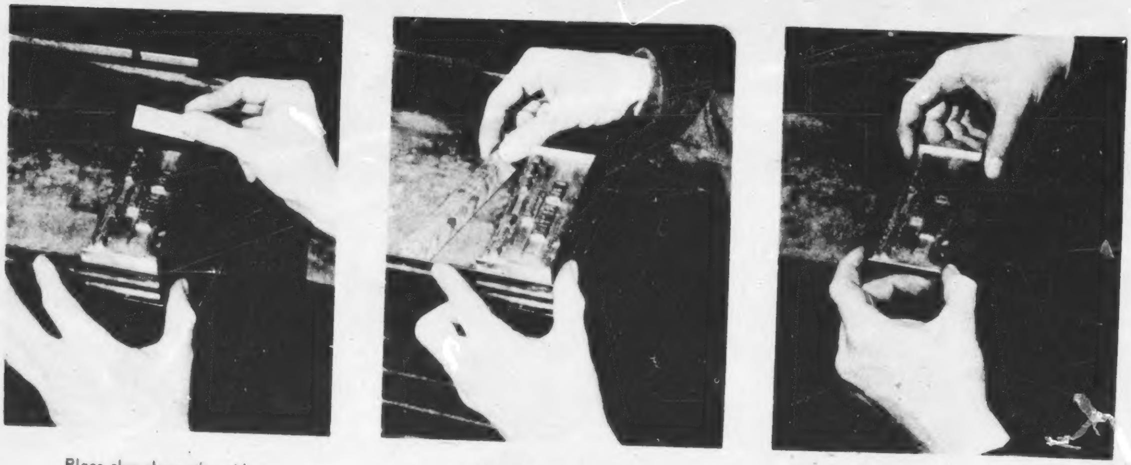
Once the type is clean and the proof has been marked, you can correct the errors in the form. If most of the job was set out of one case, you can take your galley back to the case from which it was set. Place the galley on the slanted work bank over the type cabinet so that you can work with a minimum of effort. (See fig. 17-17.)



Put rules in galley as shown.

Add a slug along the side.

Slip type in galley. Lead out lines.



Place slug along other side.

Add bottom and side rules.

Test corners by squeezing.

57.505

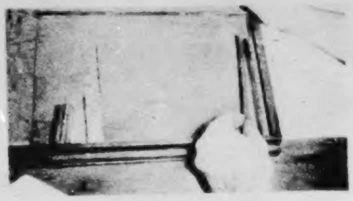
Figure 17-13.—Putting a border around a job.

Next, examine the proof, correcting the type line by line, as you go along. If the correction simply involves inverted letters or one-letter changes, which do not affect the length of the line, you can pick out the incorrect letter and insert the correct one in its place by the method shown in figure 17-17. If the correction affects the length of the line, however, it is necessary to take the line from the form and rejustify it in the stick. If there are a lot of corrections involving many lines, it is sometimes easier to reset the entire paragraph.

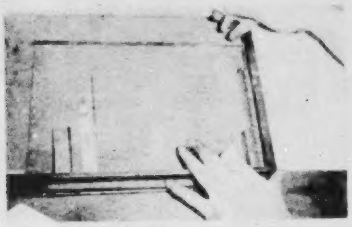
Reproduction Proofs

If the type is to be used for reproduction proofs, you should put the form back on the press after it has been corrected and pull another set of proofs. Reproduction proofs are just like the other proofs except that they must be sharper and cleaner. They are generally pulled on coated book stock and the ink should be even and black.

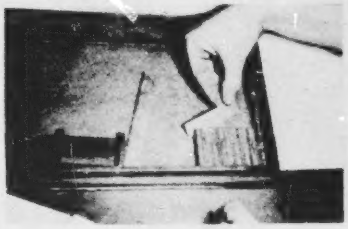
It is not possible to pull good reproduction proofs on a proof press like that shown in figure



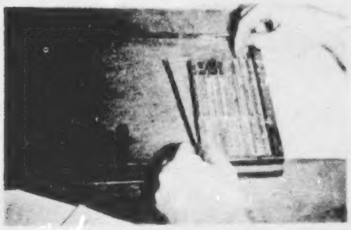
Set the heading in one or two lines extending the full width of the table. Place it in the galley. Then add a parallel rule.



Next divide the over-all space between the individual columns in proportion to their importance or the amount of type in each. Set the first boxhead. Place a hairline rule below it.



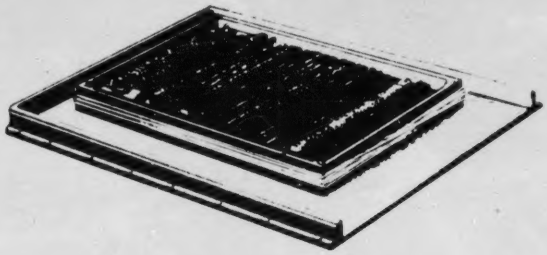
Set the entire column. Place it in the galley. Place a hairline rule of the proper length along the right side of the column of type.



Follow the same procedure for the other columns, making up the form as you go along. When the form is completed place a small rule across the bottom.

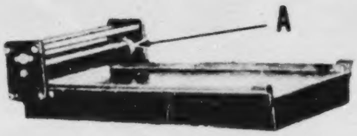
57.506

Figure 17-14.—One way to make up a ruled table.



57.507

Figure 17-15.—A type form tied correctly. To untie it, pull up on the loose end of string.



57.508

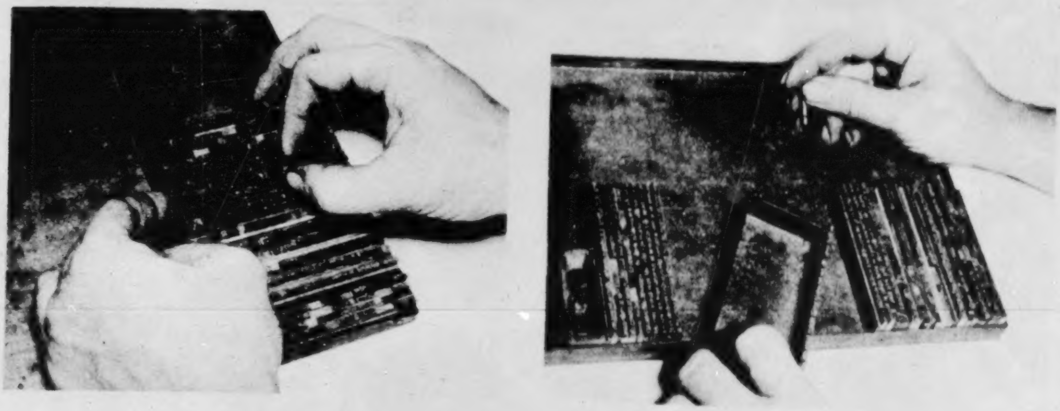
Figure 17-16.—Small proof press. Type form is put on bed of press and inked with a hand roller. Sheet of paper is positioned over type, and roller (A) is moved over form to make the impression.

17-16. If your shop does not have a precision proof press, you should pull your reproduction proofs on the platen press. You will learn more about it later in this chapter.

Pulling Proofs on Direct Image Plates

You can pull proofs on direct image (paper or plastic) offset plates, if you remove some of the packing from the press. Too much impression indents the plate causing outlined letters when the job is run. The ink should be even and sharp and you should allow it to dry thoroughly before the plate is run on the offset press.

Always find your position by using sheets of plain paper cut to the same size as the direct image plate. Then when your guides are set properly, you can pull an impression on your plate. The image is generally placed 2 inches from the top of the plate, and centered left to right. By pulling one proof and then moving the



57.509

Figure 17-17.—Correcting the type. Left, lifting the line enables you to get at the letters when making simple corrections. Right, complicated corrections affecting the length of the line are made in the stick.

type to a new location, you can repeat the image on the plate.

After the proofs have been pulled, you should hold the type for a day or two until you are sure that you will not be needing it again.

Transparent Proofs

Sometimes reproduction proofs are pulled on cellophane or acetate sheets. These proofs may be used for contact printing on positive-working plates or for reverse printing on negative-working plates. They are used most frequently for contact printing on film, however, as they make possible the producing of a negative without the use of a camera. Transparent proofs may be pulled on a platen press, but special proof presses are generally used.

After pulling these proofs, you should examine them with a magnifying glass over a light table to see if the letters are completely opaque. If they are not, you can dust them with lamp black or powdered bronze. Then allow them to dry 4 or 5 hours before attempting to use them. If the dried prints are to be used for paste-ups, you can wax their backs with a waxing machine or by pulling them through a pan of melted wax.

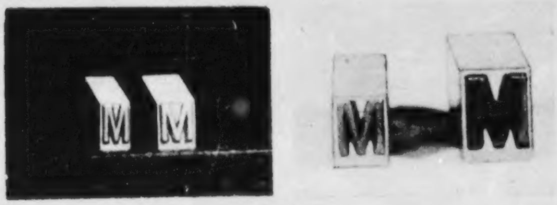
DISTRIBUTING THE TYPE

What happens next depends on the purpose for which the type was set. If the type was intended only for reproduction proofs, the form is said to be dead after the reproduction proofs have been pulled and approved. And since the type is no longer needed, it is distributed (put back in the proper boxes in the case).

Figure 17-5 shows the steps involved in distributing a dead form. First clean the type and transfer it to a galley–with the head of the form at the top (closed end) of the galley. Then place the galley on the work bank.

Next, determine which case the type came from. If the type is all from one case, your problem is simple. But if you have been using several kinds of type, you will have to examine each face carefully to make sure that you get it back in the proper drawer. Many type styles are similar and it may be difficult to tell them apart by just looking at the faces. (See fig. 17-18.) You will find that the nicks are a help in identification because they generally match on all types of the same size and style.

You must also be careful not to get the wrong size of type in the case. But checking size is easy. You simply compare a letter from the type



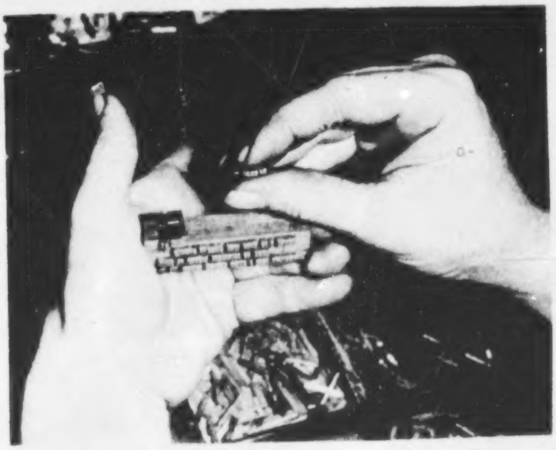
57.510

Figure 17-18.—Type faces have many subtle variations. Besides differences in weight (boldness) and style, they also come in condensed, expanded, and medium widths. Always compare the type from the form with the type in the case before distributing.

you are about to throw in with the same letter taken from the case. (See fig. 17-18.)

Once you have determined the case the type is to go into, you can take 3 or four lines from the end of the form, holding them in a horizontal position between the thumb and middle finger of your left hand, as shown in figure 17-19. Lines should be held upside down so that the words will read from left to right.

Beginning at the right end of the top line take a word or as many letters as you can hold between the first finger and thumb of your right hand. Use the third finger of your right hand to kick the letters off (one at a time) into the proper boxes in the case. Letters should drop off in order as in spelling. For example, you will notice that the man in figure 17-19 is holding the word "sincere" in his right hand. As he distributes it, he will first throw in the "s"; then the "i"; then the "n"; and so on.



57.497.5

Figure 17-19.—How to hold the type during distribution.

Quads and spaces must also be returned to their proper boxes in the case. At first you may find it difficult to tell the spaces apart, but after awhile you will be able to distinguish between them—just by the feel.

After you have distributed the type, be sure to put all the leads and slugs back in the rack where they are kept and put away all the metal or wood furniture that you used in blocking out the form.

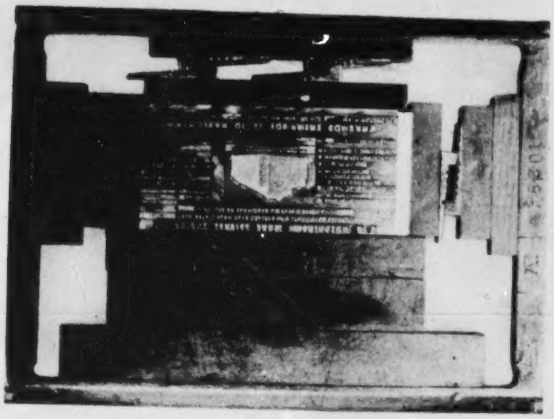
LOCKING THE FORM

Now let's get back to forms that are to be proofed or printed on the platen press. In this case after you have finished setting the job, you should slide the form off the galley onto the stone (worktable). Place the metal frame (chase) around it so that the type is in a position that will make for easy feeding on the press. Most forms are placed slightly to the left and above the center of the chase. You should also position the type so that when the chase is put on the press, the head of the form will be either to the left or to the bottom. This will ensure that the head will always be toward the feed edge of the press and it will be easier to watch the job as it is run.

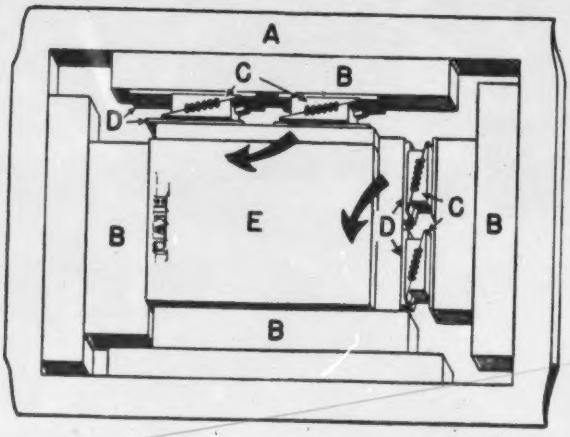
You must block the form in the chase with metal or wood furniture, as shown in figure 17-20. If you can find furniture the same length of the form, use that; but be sure that the furniture does not bind and thus fail to hold the type properly. You can prevent binding by inserting an extra lead for squeeze.

If the job does not conform to any standard measure that the furniture comes in, you can build it out by adding metal furniture on one side, or you can overlap the furniture, as shown in figure 17-21.

First fill in the space at the top and left side of the form. Use the longest and fewest pieces of furniture possible. Place the longest furniture near the edge of the chase, as this helps spread the tension when the form is locked. Then put



57.496.3
Figure 17-20.—If the form is long and narrow, the head should be at the left of the chase, as shown in figure 17-21, if it is short and wide, the head should be at the bottom, as shown here. The quoins should be at the top and right sides of the chase when the form is put on the press.



A. Chase.
B. Wood furniture.
C. Quoins.
D. Reglets.
E. Form.

57.513
Figure 17-21.—How to lock the form. The inside part of the quoins must always point toward the solid sides of the chase. Notice that the quoins are closer to the type than to the chase.

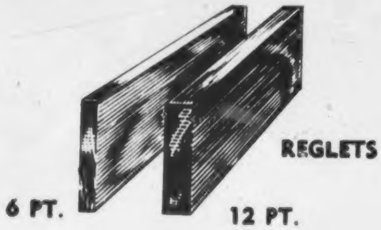
furniture at the bottom and right of the form, leaving space for the quoins. Use wood reglets, like those shown in figure 17-22, for filling in the narrow spaces and slip a reglet between the quoins and the sides of the chase. Never run a job with the metal quoins against the chase as they are liable to slip.

Before you insert the quoins, be sure to remove the string from around the type. Most printers save the string and use it again if it is in good condition.

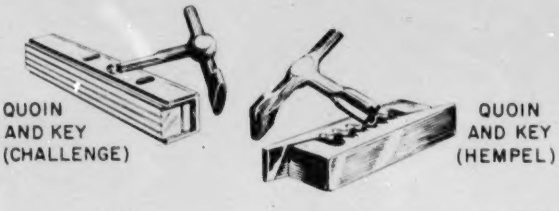
After the string is removed, you can insert the quoins in the space remaining at the bottom and right of the form. (If the form is very large, it may be necessary to place the quoins at the top and left to provide the proper margins when the job is run.)

The quoins should always point in the direction shown in figure 17-21, so that the squeeze is directed toward the solid corners of the chase. You can lock (expand) the quoins with a quoin key like that shown in figure 17-23. Insert the key and turn it clockwise to lock the bottom quoins and turn it counterclockwise to lock the side quoins.

Before you lock the form, you should place a wooden block or planer, like that shown in figure 17-24 on the type and tap the block lightly with a mallet or with the quoin key to force all the letters down against the stone. If the type is not level after you have planed it, don't force it. Check to see if there is some dirt or foreign matter under it.

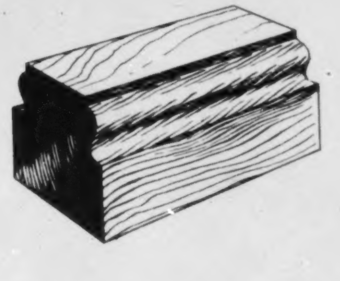

REGLETS
6 PT.
12 PT.

57.514
Figure 17-22.—Reglets are strips of wood 6 or 12 points thick. They are similar to slugs and can be used in the form instead of slugs, although they are used chiefly in filling in narrow spaces when the form is locked in the chase. They are available in long strips and in ready-cut assortments. They may be kept in racks or in a drawer with the quoins and quoin key.



57.515

Figure 17-23.—Quoins and keys are used in locking forms. Hempel quoins are used for many types of work. Challenge quoins have numerals on their faces which indicate the number of points the quoin has expanded to permit relocking to the same pressure.



57.516

Figure 17-24.—Wood planer. Proof planers, similar to this (except that their bottoms are covered with felt) are sometimes used in pulling proofs.

Plane the form before you lock it and as you lock it to make sure the type locks evenly. But do not plane the locked form.

Tighten the quoins a little at a time, going back over them until all are tight. Don't try to force them, as this might break the chase. When the quoins are tight, lift one side of the chase enough to slip a piece of furniture under it. Then test each line with your fingertips to see if anything is loose. If a letter is loose, determine what is wrong. Then unlock the chase and correct the condition. A thin space will often do the trick. Never let a loose form go to press, because it may come apart in the middle of the run.

Always wipe off the bottom of the type before putting the chase on the press. Carry the chase with both hands, like you would carry a pane of glass.

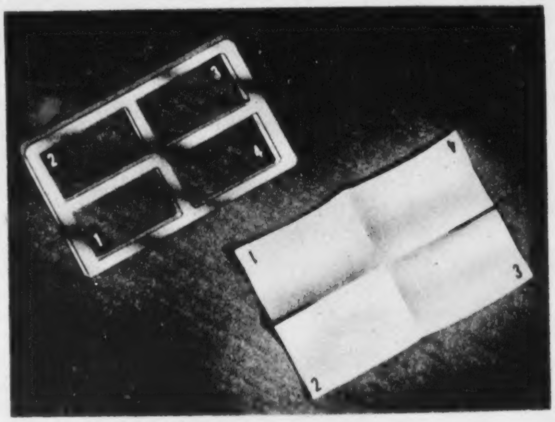
MULTIPAGE LOCKUPS

There may be times when you will want to run two or more forms at the same time. You can cut press time in half by setting two duplicate forms and locking them in the chase side by side (two-up).

Lockup for this kind of work is the same as that for a single form, but you must be sure to leave proper marginal space between the two forms. In bookwork, you must also determine which page goes where, but this is not difficult. You simply make up an imposition chart, similar to that used in stripping the negatives for the offset press. Figure 17-25 shows how to find the positions for your pages when you are using such a chart.

KINDS OF PRESSES

The three types of presses used for letterpress printing are the platen, the cylinder, and the rotary. Rotary presses fed from continuous rolls are called web presses. Most newspapers are printed on this type of press.



57.517

Figure 17-25.—Right, an imposition chart for a 4-page folder. Left, the arrangement of the pages in the chase. Notice that the bottom of the chart is placed against the bottom of the form and that the positions of the pages are reversed in the chase.

Open Platen Presses

In the Navy, your work will be confined largely to the platen press (sometimes called the kicker). Figure 17-26 shows the operating parts of this press. The chase holding the form is clamped against the vertical flat surface or bed at the back of the press. The paper is hand-fed—one sheet at a time—to guides on another flat surface known as the platen. When the press is in operation, the bed moves forward slightly and the platen tilts to a parallel position until the two meet and the paper is pressed against the type. (See fig. 17-27.) By pushing a throwoff lever, the pressman can move the bed of the press away from the platen and thus prevent the press from making an impression when he is not feeding or when he misses a sheet or feeds it crooked.

Tympan

To provide the proper contact between the type and the paper, the flat surface of the platen is covered with several sheets of underpacking and a drawsheet of manila paper. The drawsheet and packing are known as the tympan, and the paper used for the drawsheet is often called tympan paper. A sheet of hard, springy cardboard (pressboard) and 2 or 3 sheets of 50-pound supercalendered book paper make an excellent packing. The drawsheet is clamped in place on the platen with two metal bars known as tympan bales. (See fig. 17-28.)

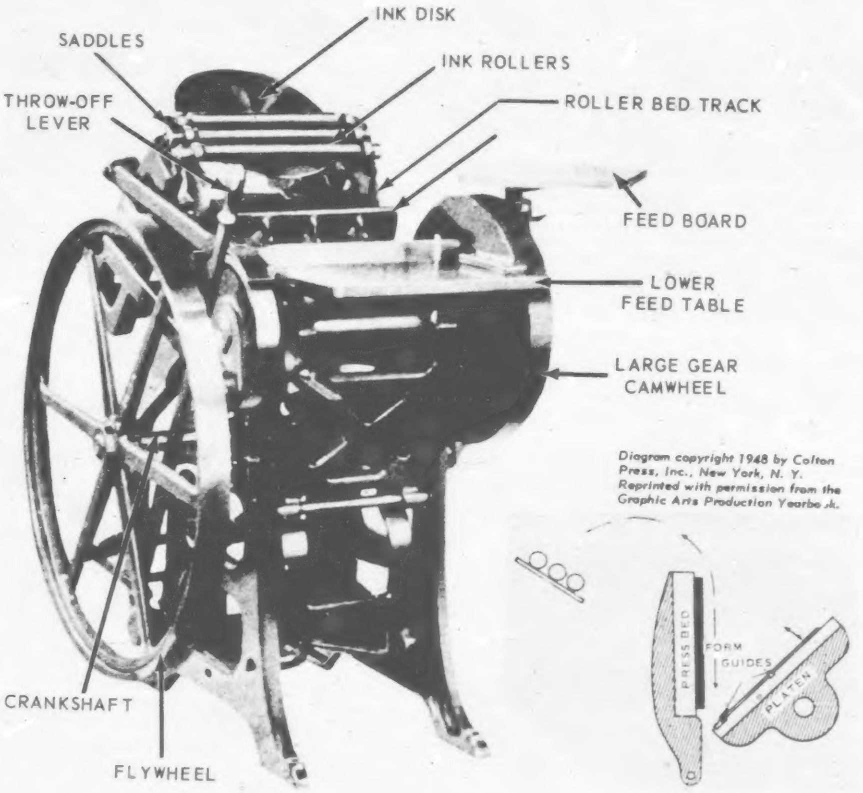
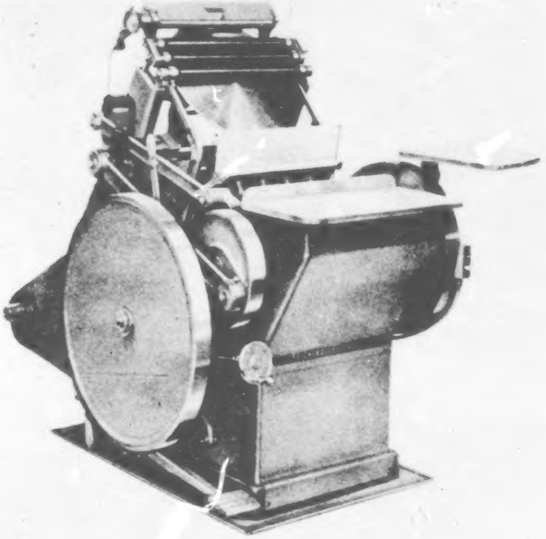


Diagram copyright 1948 by Colton Press, Inc., New York, N. Y. Reprinted with permission from the Graphic Arts Production Yearbook.

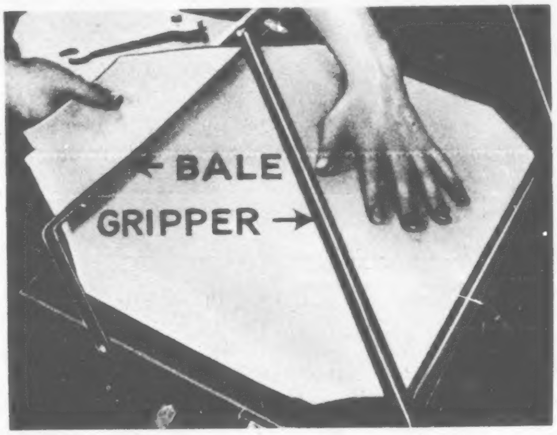
57.518X

Figure 17-26.–The operating parts of the open press. These presses come in several sizes, but 8″ × 10″ and 10″ × 15″ are the most common. Diagram below shows how the press works.



57.519X

Figure 17-27.—Late model platen presses differ in appearance but operate on the same principle as press shown in figure 17-26.



57.520X

Figure 17-28.—Putting a packing on the platen press. Fasten one end of the drawsheet under the tympan bale; then insert the packing sheets. Stretch the drawsheet taut and then clamp it with the other bale. Tear off the excess paper. Always reclamp the bale before starting the press; otherwise you may damage the form or the bale.

Inking System

The ink fountain is similar to that found on the offset press. Thumbscrews are used to control the distribution of the ink. When the press is in operation, the ink rollers swing up over the ink disk to contact the fountain roller; then back over the disk down over the type form; then up over the disk to the fountain roller again, and so on. When the top roller contacts the fountain roller, it picks up a narrow strip of ink which it transfers to the disk. As the other rollers pass over the disk, the ink is distributed evenly. The disk revolves slightly with each revolution of the press, further aiding in the distribution.

The fountain roller is metal, but the other rollers consist of a metal core covered with a soft, rubbery composition of glue and glycerin. The rollers are sensitive to heat and moisture. In hot climates, you should use hard "summer" rollers or "all weather" rollers. Rollers cast for winter use contain more glycerin than the others and are apt to melt or come apart when they are used in hot weather.

Rule forms cut into the soft surface of the rollers and shorten their lives, so it is best to use a set of old rollers when running such work. Always stop the rollers at the bottom of the press. Never leave them resting against the type or on the disk, as this will flatten them.

You can attach a roller to the press by pulling out on the roller arm and slipping the ends of the roller core into latch-like devices, known as saddles. (See fig. 17-26.) To remove the roller, you simply reverse this process. Rollers are held in place by spring tension. A ledge (bearer) on each side of the press bed acts as a roller track. It helps maintain the proper contact between the rollers and type and causes the rollers to turn as they pass over the form. A small steel wheel (truck) slips over the core at each end of the roller and provides the proper contact between the roller and the track. Expansion trucks are sometimes used instead of the regular trucks. The pressman can adjust them to regulate the pressure between the rollers and the form.

Always wash the rollers and the disk with roller wash when you are through using the press. If the ink—especially colored ink—is not removed, it will cause the rollers to harden and poor ink distribution will result. When rollers are removed from the press, they should be placed in a rack or stood on end against the wall.

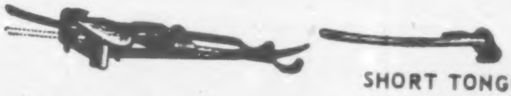
Other Parts and Accessories

The feedboard, shown in figure 17-26, is used to hold the stock that is to be fed into the press. It can be pivoted to any position that makes for easy feeding. The operator stands before the press and takes the paper–one sheet at a time–from the feedboard and places it on the platen against a set of gage pins, like those shown in figure 17-29. These pins serve as guides for registering the paper. After each sheet is printed, it is taken from the press and stacked on the delivery or lower table shown in figure 17-26.

Two grippers, like the one shown in figure 17-28, prevent the sheet from sticking to the form after the impression. These grippers are not the same as the grippers found on the offset press. They are simply long, metal fingers which ride between the platen and the bed of the press. When the platen moves against the type to make the impressions, the grippers close on the margins of the sheet; and when the platen moves away from the form, they hold the paper momentarily to keep it from sticking to the type.

Always see that the grippers clear the form before pulling your first impression, because they will ruin the type if they strike it. You can move the grippers sidewise along a bracket below the edge of the platen. They are held in place with locknuts and can be removed from the press entirely if necessary.

Use the flywheel, shown in figure 17-26, for turning the press over by hand. Most operators also turn the wheel by hand to relieve the strain on the motor when they start the press. Some platen presses are equipped with a brake, like that shown in figure 17-27. It is used in stopping the press after the motor is shut off.



57.521
Figure 17-29.–Gage pin. The tongue can be pushed in or out.

Inking the Press

Always ink the press before putting on the form. Otherwise the ink may fill in the small letters and you will have to stop and wash the type. If your press is equipped with an ink fountain, you simply put the ink in it and regulate the flow with the thumbscrew adjustments. If you have no fountain, you should apply the ink in small quantities with an ink knife in 2 or 3 separate places on the disk. Then let the press run for a few minutes to distribute it. A little ink goes a long way, so don't use too much on small forms. If you get too much, stop the press and wash the disk.

If your press is not equipped with a fountain, you will find it necessary to add ink during the run. Apply it to the lower left edge of the disk and allow it to distribute thoroughly before making another impression.

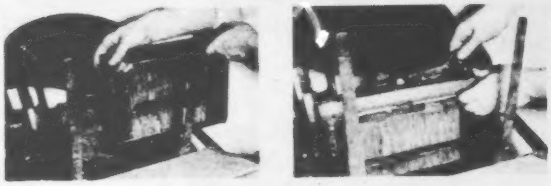
The rollers and plate must be washed thoroughly each time you switch from one color of ink to another. If the run is very short, you may not want to use the fountain, so you can move it back or throw it out of gear and ink the disk by hand.

Putting the Form on the Press

Once the ink is distributed, you can put the form on the press. Turn the flywheel until the inking rollers are in their lowest position. Then insert the chase against the beveled lugs at the bottom of the bed and lock it in place by slipping it under the clamp at the top, as shown in figure 17-30. If you have locked the form properly you should put it on the press with the quoins at the top and right sides of the chase as shown in figure 17-30.

Makeready

After the form is clamped on the press, your next step is to pull a print on the tympan. But before you do this, you must remove the gage pins from the drawsheet and move the grippers to the far sides of the platen so that they will clear the type when you make the impression.



57.496:497

Figure 17-30.—Putting the form in the press from the side. You can also put the form in from the front. Always lock the chase in position with the clamp as shown at right.

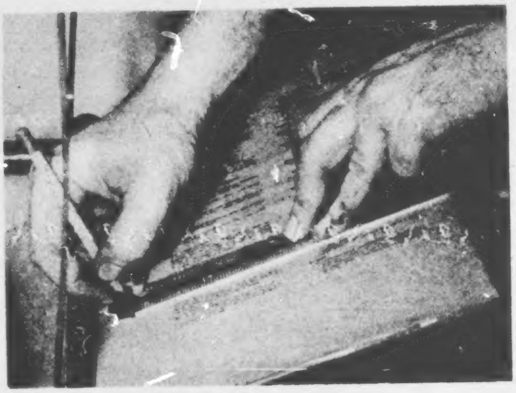
You may be able to run 3 or 4 similar jobs without changing the tympan, but for best results, the drawsheet should be changed frequently. Furthermore, you should vary the thickness of the packing according to the job being printed. For medium forms, you can use 1 sheet of pressboard and 3 or 4 sheets of 50-pound supercalendered book under the drawsheet. But smaller forms may require less packing and larger forms may require more. If the form is made up of cuts and new type, most pressmen place the pressboard next to the drawsheet, but if the type is worn, it is often necessary to place the pressboard under the super to provide a softer packing.

When the packing seems sufficiently high, turn the press by hand and pull a print on your drawsheet. This will show you the position of your form, and you can set your gage pins to it. You can powder the drawsheet later with talcum powder to dry the ink and prevent it from offsetting onto the back of the printed sheets.

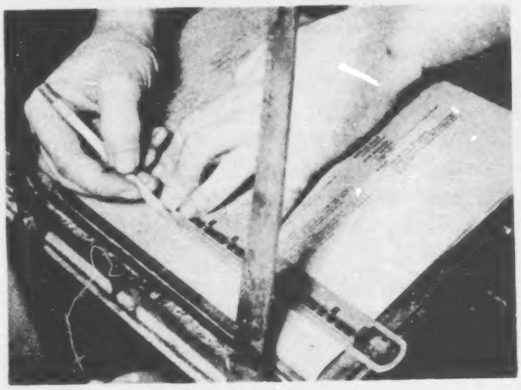
Setting the Gage Pins

The margins of your printed sheets are determined by the positions of your gage pins. There are several ways to find the correct positions for the pins. The simplest way is to subtract the width of the form from the width of the sheet. This will give you the total marginal space. If the form is to be centered, the bottom margin will be equal to half of this space. So you simply measure with the line gage from the lower edge of the impression pulled on the tympan.

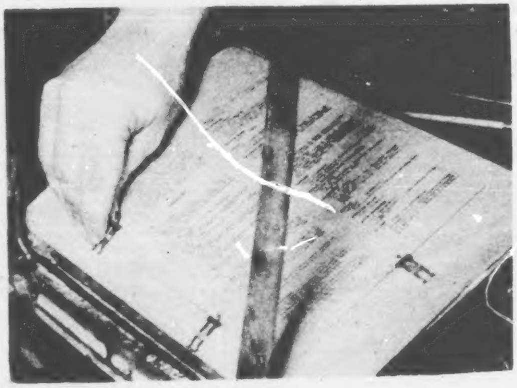
Mark the drawsheet in a couple of places, as shown in figure 17-31. Then draw a line to connect the two points. This will be your



Measure from the lower edge of the impression.



Mark the drawsheet at two points.



Draw a line to connect the two points.

57.523

Figure 17-31.—One way to find the positions for your gage pins.

bottom margin line and you can set the guides to it, as shown in the illustration. The side margin can be established in the same manner.

To set the pins, you simply push the sharp points into the drawsheet, just behind the margin line. Then slide the pins down until their front shoulders are even with the pencil line. As a rule, you should use 2 pins along the bottom margin line and 1 on the left side. You must be careful, of course, not to set the pins where they will be struck by the grippers, as the grippers will damage them. You should also see that the tongues in the pins do not protrude far enough to hit the type when the impression is made. If they do, you must slide the tongues back in the pins or move the pins to a new location.

After you have set the pins, you should pull a proof on one of the sheets to be run in order to test the margins. Fold the printed sheet in the center and hold it up to the light to see if the margins are equal and if the type is straight with the edge of the paper. If it isn't, you must move the gage pins in or out until the image is positioned properly.

Once your margins are correct, you should take a small wrench and lightly tap the pins to drive the tips of their shoulders into the packing. This will keep the pins from slipping during the run.

When gage pins are not available, you may use quads glued to the tympan as paper guides. You may fashion tongues from slender strips of pressboard and fasten one to the top of each quad with Scotch tape.

Setting the Grippers

You have already seen that you should never pull an impression without first checking the grippers to see that they clear the type. Generally it is necessary for you to move the grippers to the extreme edges of the platen during preliminary operations. To reset them later, you must pull a trial impression on a sheet of the stock to be run, and then with the sheet against the pins, move the right gripper over the right margin of the sheet. Hold it down against the tympan to see that it misses the type, and tighten the nut to hold it in place.

If there is room, you may be able to set the left gripper in the same manner, although, as a rule, it is necessary to set this gripper behind the left gage pin. Don't set the gripper over the pin, because the gripper will damage it.

To provide additional stripping power, you can attach extension fingers to each gripper, or you can stretch string (or a rubber band) between the two grippers at one or more points where it will not contact the form. (Metal extension units are shown in figure 17-37.)

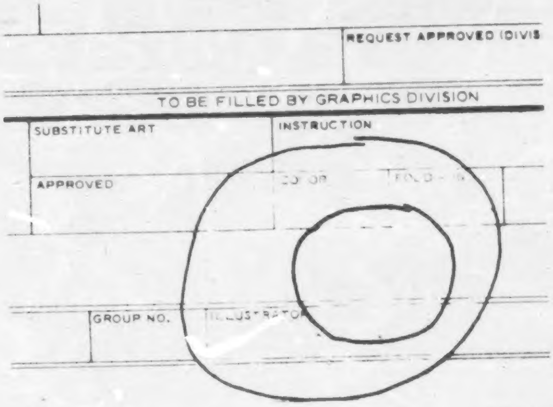
Getting an Even Impression

Examine the first proof carefully for ink and printing defects. If your shop does not have a proof press, you should also read your first proof for errors. Then remove the form from the press and correct the errors. Once the corrections have been made, put the form back on the press and pull another proof. Check the second proof to see if all the corrections have been made. If you find that an error has not been corrected or if you find dirty or broken letters, you must remove the form from the press again to make the correction.

Unless your type is new or in fairly good shape, you may find that some letters will show up clearly while others will look worn and weak. You will also find that borders and rules are often too high and that cuts may be either too high or too low. To obtain a satisfactory print, you will have to build up the low spots or reduce the high spots so that the printing pressure will be uniform. This building-up process can be done in two ways. You can put a piece of paper behind the type form or you can put paper patches under the drawsheet on the platen. (See fig. 17-32.)

It is an easy matter to place a piece of paper behind a low cut or a block of type enclosed in a rule box. However, these patches should be used only where they are needed. You must locate the low place and then wet a slip of paper and stick it in place behind the form. Never use paste or gummed paper behind the form as that might ruin the type. Always start off with a sheet of onionskin or French folio. You can then apply more paper if necessary. You will find that a thin piece of paper strengthens the impression considerably.

But don't just stick a sheet or two of paper behind the form and let it go at that. This



57.763

Figure 17-32.—By outlining the low areas, you can establish the shape and position for the overlay patches.

method will bring up the weak parts of the job, but it may also cause too much pressure on the heavy parts and this will cause damage to the type. Therefore when accurate make-ready is necessary, you must place patches under the drawsheet. This is called "overlaying." It may be done in two different ways. You can use a double drawsheet or you can use a spot sheet. If you use a double drawsheet, you simply unclamp the top sheet and roll it down on the platen; then pull an extra impression on the second sheet. You will then have two impressions in exactly the same position and you can paste your paper overlays on the low spots indicated on the second sheet. When you are finished you can stretch the top sheet back into position.

The other method of overlaying employs the use of a spot sheet of heavy, supercalendered paper. Pull an impression on the sheet of paper; then turn it over and study the impression showing on the back.The low areas will show up readily on this type of paper and you can take a pencil and outline them. Begin first with those areas that will require only slight building up and gradually proceed to those areas that will require a considerable amount. The center of a large form is often lighter than the edges and isolated bits of type always print heavier than those areas which are adjacent to other blocks of copy.

Some operators place a sheet of carbon paper against the face of the super before outlining the low areas so that the carbon will make the outlines appear on the face of the super.

Once the outlines have been drawn, you can turn the paper over and paste pieces of onion skin over the areas indicated.

Rub the paste over the area to be built up; then lay a piece of onionskin paper over it and, using an overlay knife, carefully cut along the outline. Remove the trim so that only the area enclosed by the outline will be covered. Always begin with the smallest outlines--those which indicate your lowest areas. You can then build up the impression progressively by adding larger pieces of paper, one over another until the entire blocked-in area has been covered.

Next, you must slip the spot sheet under the drawsheet, placing it so that the print on the pasted-up sheet will register perfectly with the impression on the drawsheet. To do this, you simply place the spot sheet against the pins on the drawsheet and then cut two right angle slits through both sheets. Then release the drawsheet and place the spot sheet under it. You can position the spot sheet by matching the right-angle slits. A little library paste will hold it in place. Don't forget to remove a sheet of super from the packing when you insert your spot sheet. Otherwise the additional thickness of the spotsheet may cause your impression to be too heavy.

As a final operation pressmen generally transfer the sheet of pressboard from the bottom of the packing to the top, placing it between the drawsheet and the spot sheet. The pressboard provides a harder printing surface and also tends to soften the edges of the patches on the spot sheet. This operation is of particular importance when you are working with halftone overlays. It prevents the outline of the patches from showing up in the impression. In halftone work, the darker areas generally require more impression than the highlights. For example, you might cut out a small area in the eye of a person in a halftone while building up areas of the hair or background.

Envelopes

The front, back, and flap of an envelope overlap and cause an uneven impression because there are more thicknesses of paper in one part of the printing area than in another. You can handle this problem by using a spot sheet to build up the low areas, following the procedure just discussed. In areas where the different layers of the envelope overlap, no patch will be required, but one, two, or even three patches may be required in other areas. To save time, you can cut paper from one of the envelopes and use this paper in preparing the patches.

(Note–If one side or one corner of the platen is low, you can bring it back into parallel with the press bed by adjusting the regulating nuts under the corners of the platen. This operation will seldom be necessary, however.)

Feeding the Press

When the job is ready to go, place the paper on the feedboard and fan the pile so that the top sheets will overhang the others. Then set the counter on the left side of the press.

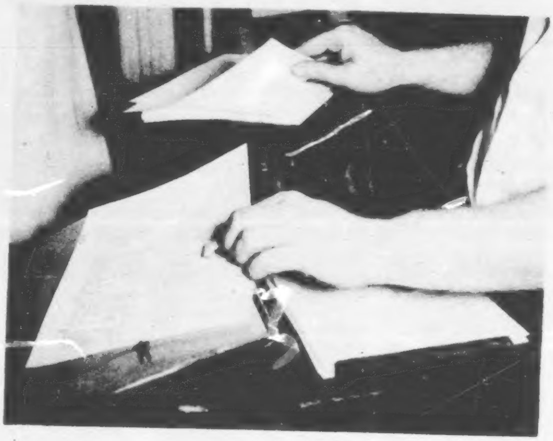
Rub some glycerin on your hands so that it will be easy for you to pick up the sheets. See that the throwoff lever is in the throwoff position; then start the press, giving the flywheel a spin with your left hand to relieve the strain on the motor.

Stand directly in front of the press, as shown in figure 17-33. Take the top sheet from the stack with the thumb and fingers of your right hand and place it against the guides on the platen. Slide it over until it touches the left pin–and then release it immediately.

Feed the sheets into the press with your right hand, and remove them with your left, as shown in the illustration. You must handle the sheets carefully when you remove them, as the wet ink smears easily. You will find it easier to keep the sheets clean if you use a sandpaper stall (a strip of sandpaper folded over the finger and secured with a rubber band) on the first or middle finger of your left hand.

Never reach into the press to try to straighten a sheet after you have inserted it. If your hand gets caught between the platen and the type, you are liable to lose a finger.

If you miss feeding a sheet or get one in crooked, use the throwoff lever to throw off the impression. You can operate it with your left hand.



57.524

Figure 17-33.–Feed the sheets into the press with the right hand and remove them with the left. Notice the sandpaper stall. It will help you to remove the sheets without smearing the wet ink.

Push the lever toward the back of the press to throw off the impression and move it forward to bring the press back on impression. Don't hesitate to use it as often as necessary. It's a safety device and it's there to help you. In fact when you are learning to feed the press or are running difficult forms, you can use the throwoff throughout the run, printing every other sheet.

Be especially careful when feeding a platen press during heavy weather. The roll and pitch of the ship tend to disrupt the steady cadence provided by the inertia of the flywheel. Since the feeding operation is largely a matter of timing, a sudden change in speed can be dangerous if not anticipated.

During the run, check the prints periodically for:

1. Too little or too much ink.
2. Margins slipping.
3. Type working off its feet.

Remove the printed sheets from the delivery table frequently and stack them in small piles to prevent offset.

At the end of the job, transfer the form to the stone, and wash the type with solvent. At the end of the day, or each time you change color, you must wash the press thoroughly with solvent and a soft rag.

Oil the press at least once a day, if you are using it continuously. Most oil holes are apparent on this press, but it is necessary to turn the machine until the platen meets the bed to reach some of them.

If you are under way and encounter even moderately choppy seas, you should lash your platen presses closed when they are not in use. Many operators lash the presses at the end of each working day so that it will not be necessary for them to get up during mid-watch in case there is a change in the seas. To lash the press, turn the flywheel until the platen closes against the bed; then take a few turns around the bed and platen with a length of small line. Before closing the platen, remove the ink rollers from the press to prevent them from developing flat spots.

Scoring and Perforating

It is sometimes necessary to score heavy stock so that it can be folded by hand. The scoring rule dents or breaks the stock but does not cut through it. Special steel rules are provided for this type of work, but regular brass rules can be used. When scoring a job, pressmen remove the rollers from the press.

Perforating rules are similar to scoring rules except that they are designed to cut small slits or perforations in the paper. You can perforate a job as you print it, or you can lock the perforating rule in another chase and perforate the work in a separate run. Since perforating rules damage the rollers, most pressmen use a set of old rollers or remove the rollers entirely when they are perforating a job.

Numbering Machines

A small mechanical device, known as a numbering machine is used for printing consecutive numbers on jobs such as tickets and invoices. These machines are locked in the form much the same as a cut. The numbers print along with the type and change automatically after each impression. (The form shown in figure 17-11 has a numbering machine in the lower left corner.)

AUTOMATIC FEEDER PRESSES

There are several types of automatic feeders for platen presses, but most of them are similar in principle, and when you learn to operate one, you can easily switch to another.

THE KLUGE FEEDER

The Kluge (pronounced Kloog-ee) automatic press and feeder are shown in figure 17-34. Kluge feeders are built for both the 10" X 15" and the 12" N 18" presses.

How the Kluge Operates

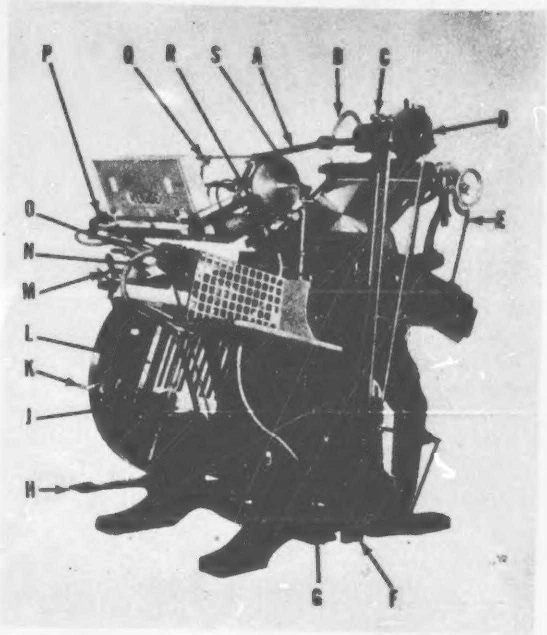
Figure 17-35 shows the feeding unit (known as the magazine). You will notice that the stock is not stacked flat, but is placed on end against an elevating feed table, which moves forward gradually as the sheets are fed into the press.

The normal position for the stack is one-fourth inch below the sucker feet when the feed arm is all the way up, but you can regulate screw (A) to make the stack run higher or lower when necessary. The sucker feet do not actually contact the stack; they pick up the top sheet as it is floated by an air blast supplied by the blower tube (C), shown in figure 17-36.

When the press is turned on, the feed arm swings first into the position shown in figure 17-36 to pick up the sheet; then it swings down over the platen carrying the sheet against the bottom gage pins. At this point the sunction cuts off and the sheet is released, but the feed arm continues downward for a second before it swings back into position for the next sheet.

The side guide is a small finger-like unit which is attached to a cam-operated rod at the bottom of the platen. (See fig. 17-37.) As the grippers close on the platen just before the impression, a spring forces the side guide to move in against the sheet. And since the paper is fed into the press slightly off center, each sheet is moved sidewise for proper registration.

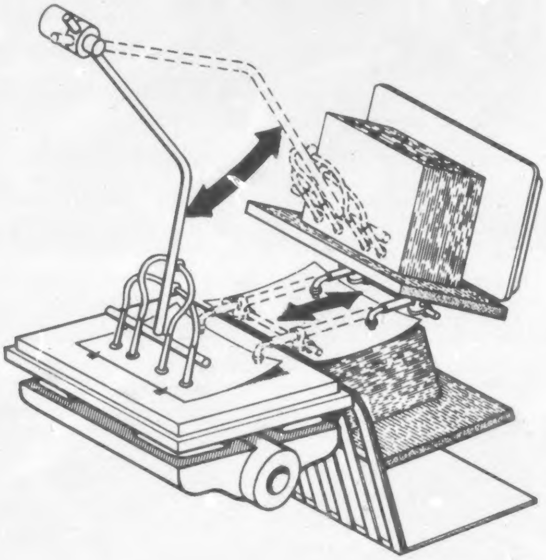
The delivery table lowers automatically as the sheets are delivered. It is self-adjusting for any thickness of stock.



A. Feeding arm.
B. Air hose.
C. Feed arm post.
D. Feed arm head.
E. Automatic ink throwoff rod.
F. Counterbalance.
G. Auxiliary table.
H. Brake.
J. Delivery table.
K. Handle for raising and lowering delivery table.
L. Delivery table piling bars.
M. Automatic throwoff.
N. Air control lever (starts sheets feeding into press.)
O. Delivery arm.
P. Magazine.
Q. Pile height regulator.
R. Blast adjustment.
S. Handle for raising and lowering feed pile.

57.543X
Figure 17-34.–The Kluge automatic press and feeder.

The impression throwoff lever and starting and stopping buttons are similar to those found on the other presses. (See fig. 17-34.)



57.544
Figure 17-35.–The operation of the Kluge feeder. Suction feet on cam-operated arm catch sheet, carrying it to pins on platen. Impression is made in the regular manner. Delivery arm then withdraws sheet from platen and carries it to an automatic receding delivery table.

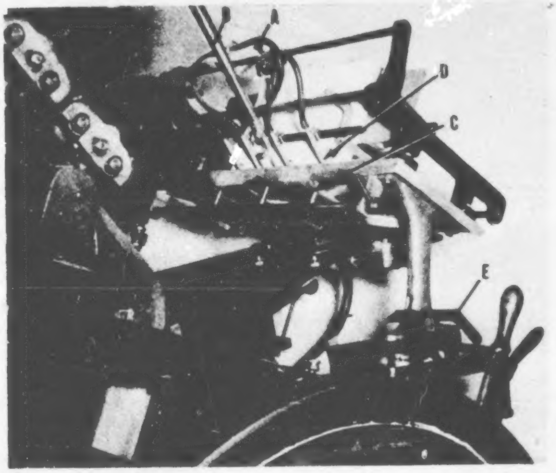
Putting a Form on the Press

The form is generally centered in the chase sidewise and locked from 6 to 8 picas from the bottom of the chase. If large forms are positioned too high, they may cause feeding or delivery difficulties. The gage pins should never be set higher than 3 1/2 inches from the bottom of the platen.

The chase is clamped on the press in the regular manner, but before you can begin your makeready operations, you should raise the feeding and delivery arms and swing the magazine out of the way, as shown in figure 17-38. To open the magazine, you simply release latch (E), shown in figure 17-36.

Makeready Operations

Makeready operations are similar to those already discussed. To change the tympan, you



A. Pile height regulator.
B. Feeding arm.
C. Blast tube.
D. Sucker feet.
E. Magazine latch.

57.545

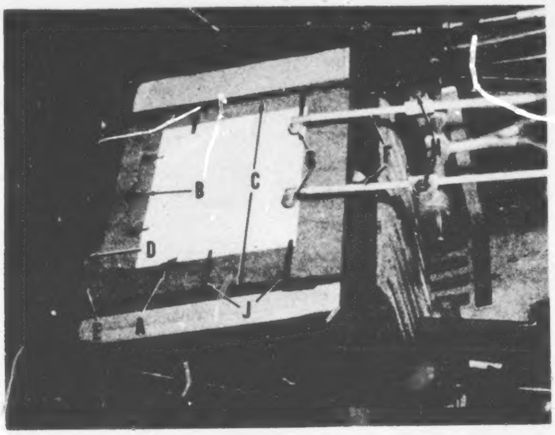
Figure 17-36.—The Kluge feeding unit.

should turn the press until the grippers are all the way up. Then clear the platen of all attachments. Remove the gage pins and the sheet gage holder tongue (B), shown in figure 17-37. Raise the side guide to keep it out of the way until the packing has been changed.

When setting the pins for a new job, you should mark the position for your side guide; then pull the grippers down against the platen to force the guide all the way in toward the form. Move the guide up to the register mark and lock it there. You can make minute adjustments later by turning the knurled screw (E), shown in figure 17-37. The bottom pins are set in the regular manner.

Sheet Holder Tongue

The sheet holder tongue (B), shown in figure 17-37, keeps the sheet from bouncing away from the pins. It moves off the sheets when the grippers close on the platen. It should overlap the sheet one-third of an inch when the paper is against the pins. If it fails to contact the sheet properly you should use a longer or shorter tongue.



A. Side guide.
B. Sheet holder tongue.
C. Grippers.
D. Side guide locknut.
E. Knurled adjustment screw for minute adjustments.
F. Delivery arms.
G. Sucker feet.
H. Bolts, Loosen to move arms in or out.
J. Extension units for grippers.

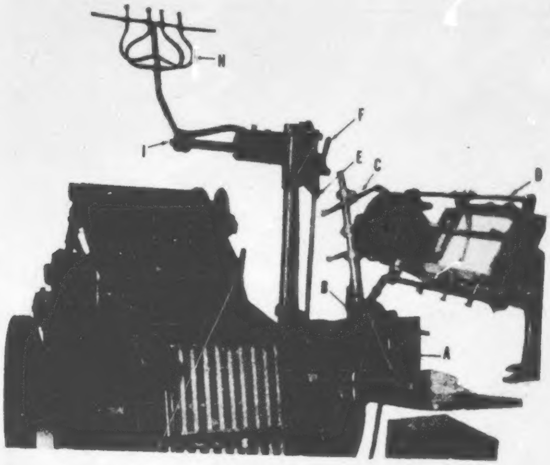
57.546

Figure 17-37.—The side guide.

Setting the Sucker Feet on the Feed Arm

The feed arm has only 4 sucker feet, but you can move them sidewise to accommodate different widths of stock. Dummy feet may be added for very large stock. Metal feet are used for the average run of work, but rubber tips may be used for heavy stock. You can cut off the suction on unused suckers when you are running small jobs.

The bolt (I), shown in figure 17-38, controls the clearance between the tympan and the feed arm and also controls the alignment of the sucker tips with the platen.



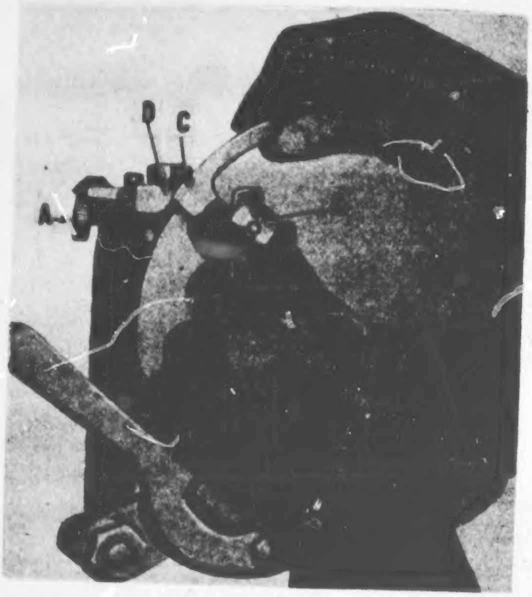
57.547

Figure 17-38.—During makeready operations you should swing back magazine (D) and raise the feed arm (H) and delivery arm (C) to the positions shown here. To raise the delivery arm, pull it all the way back and lock with latch (A.). Then raise the arm and tighten bolt (B) to hold it in place. To lock feed arm head, turn press until slot in lever (E) is ready to slip over pin on feed arm head. Force lever (E) down until slot slips over pin. Next release lever (F) and raise feed arm, turn press until grippers drop against platen. Then lower the arm gradually until it slips into the catch in lever (F) finally push up lever (E) to release the pin from the slot.

Setting the Air Release Valve

It will be necessary for you to set the air release valve so that the suction will cut off and the sheet will be released when it reaches the proper place on the platen.

To make a rough setting, you should turn screw (A), shown in figure 17-39, until the end of the screw clears the suction cutoff ball. Then turn the press until the sucker feet are one-half inch from the bottom gage pins. Next, release screw (B) and adjust until part (C) meets part (D), as shown in the illustration. Retighten screw (B), but do not change the setting of screw (A) until after the press has been turned on. After you start the press, you can regulate the air further with adjusting screw (A) if necessary.



A. Regulating screw.
B. Regulating screw.
C. Suction release lever.
D. Trip lever.

57.548X

Figure 17-39.—Air release valve adjustment.

Setting the Delivery Arm

Your next step is to release the delivery arm and lower it against the tympan. Hold it to keep it from sliding down the track too fast. When it is all the way down, turn the press until the delivery fingers are all the way out and are in contact with the platen.

You can loosen a bolt and move either of the delivery arm fingers in or out, as necessary. The sucker tips on the fingers are generally set about one-sixteenth of an inch in from the top edge of the sheet. You may use either metal- or rubber-tipped sucker feet.

Setting the Magazine

Since the movement of the side guide is limited, the paper stack must be aligned with this guide. Turn the press until the grippers are all the way up. Then place a sheet of the stock to be run on the platen against the bottom gage pins and halfway between the side register mark and side guide. (Paper fed into the press in this position will be shoved into register by the side guide when the press is in operation.)

Move the press until the feed arm drops to the platen.

Mark the position of the paper by drawing a line along the side of the left sucker foot. This mark will then serve as a guide when you place your stock in the magazine.

Close the magazine and turn the press until the feed arm is in the position shown in figure 17-40. Place the marked sheet in the magazine and move it until the pencil mark aligns with the edge of the left sucker foot just as it did when it was lying on the platen. When the two are aligned, move the right and left piling guides up to the edges of the sheet and lock them in place.

Loading the Magazine

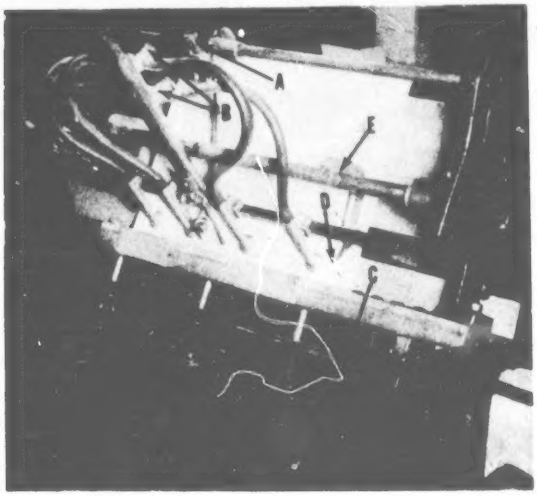
To load the stock, you must drop the elevator table (C), shown in figure 17-41. Release lever (A) and pull the table back manually. Turn handle (B) to raise the stack and push lever (A) up to engage the pawl so that the table will operate automatically after the stock is loaded.

Blast Adjustment

The blast adjustment is controlled by the thumbscrew (F), shown in figure 17-41. You can change the direction of the air by releasing the thumb nut (F), shown in figure 17-40 and turning the handle (G).

Final Adjustment of the Air Release Valve

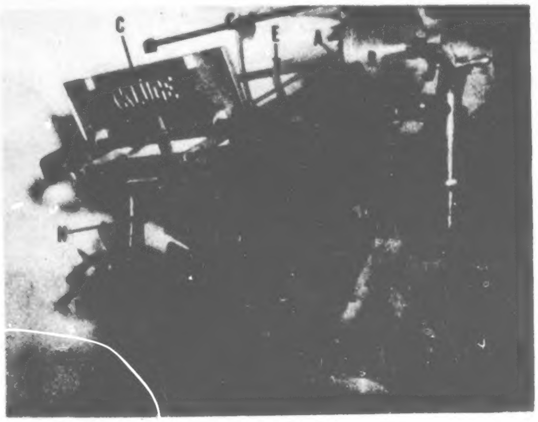
Once the press has been set up, you should check it to see that nothing is binding. Then



A. Pile height adjustment screw.
B. Individual suction cutoff points.
C. Blast pipe.
D. Separator springs.
E. Piling bar.
F. Thumbscrew.
G. Handle.

57.549

Figure 17-40.—Positioning the paper stack.



A. Elevator pawl release lever.
B. Elevator crank.
C. Elevator table.
D. Bottom plate.
E. Piling bar.
F. Blast control.
G. Auxiliary table.
H. Air lever which starts sheets feeding.

57.550

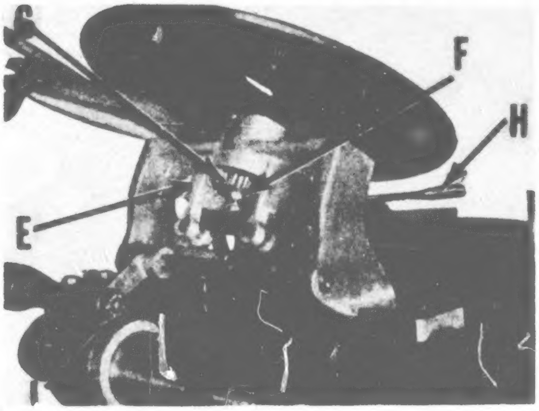
Figure 17-41.—Elevator table.

start the motor and turn the air control lever (H), shown in figure 17-41, to start the sheets feeding. Watch the sheets to see if the suction cuts off at the proper point. If further adjustments are necessary, give the adjusting screw (A), shown in figure 17-39, a clockwise turn to delay the suction cutoff or vice versa.

The timing of the suction cutoff for the delivery arm is controlled by a setscrew on the lower right side of the press.

Delivery Table

To set the delivery unit, you should run a sheet through the press, then move the piling bars up to the edges of the sheet and lock them there. The table lowers automatically when the press is in operation and is self-adjusting for any thickness of stock. You can raise or lower it by hand by releasing a ratchet pawl and turning crank (K), shown in figure 17-39.



E. Adjustment which regulates disk rotation.
F. Screw for raising and lowering disk.
G. Worm gear.
H. Lever for lowering disk (for cleaning purposes).
I. Cam roller.

57.551X

Figure 17-42.–The ink disk (with ink fountain removed).

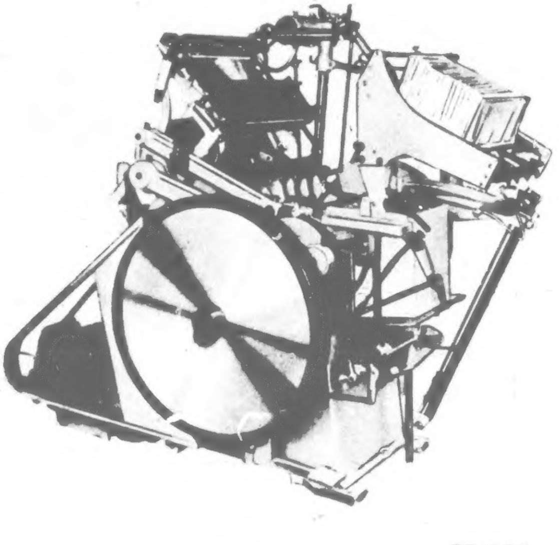
Inking System

The ink fountain is similar to that already discussed. The ratchet (E), shown in figure 17-42, controls the distance the disk rotates with each revolution of the press. The disk is slightly higher in the center than it is along the edges and you can raise or lower it with screw (F) to provide proper roller contact. Lever (H) is for lowering it during cleanup operations.

Kluge rollers are equipped with a special kind of truck known as a micarta roller truck. These trucks come in large and small sizes. The small sizes are used if the rollers shrink.

The Kluge Model D

Figure 17-43 shows the Model D Kluge press. The operating controls on this press are similar to those already discussed. The feed arm is made of aluminum and there is only one adjustment for raising or lowering it to compensate for different weights of stock. You can make this adjustment by releasing the two bolts at the point where the feed arm is connected to the shaft which extends from the feed arm head. Set the arm to the proper position and tighten the



57.675X

Figure 17-43.–The Model D Kluge press.

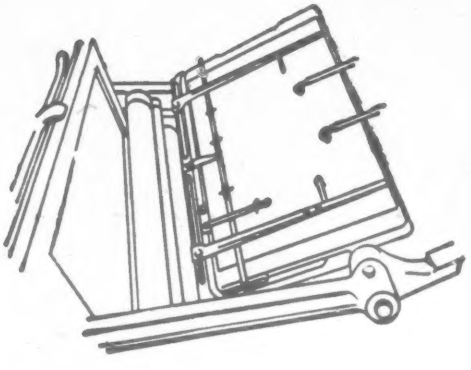
two bolts. Always set the arm as close to the platen as possible.

The built-in bottom gages shown in figure 17-44 are attached to a metal band which extends across the platen. You can release a screw and move the gages sidewise as necessary and you can raise or lower them on the platen as a unit to provide for the proper setting of the sheet in relation to the form in the chase.

LETTERPRESS CUTS

In letterpress printing, all illustrations are printed from plates having a relief image. These plates, known as cuts, are made by a process called photoengraving. Figure 17-45 shows the steps involved in making a cut. The process is similar in some respects to the procedure used for making offset plates. However, stripping film is generally used for making the negatives used in photoengraving. After the negative is developed, the photoengraver peels or strips the emulsion from the film base and mounts it onto a sheet of glass. A sheet of sensitized metal is then exposed through this glass negative layout, just as in the offset platemaking process. The copper or zinc plates used in photoengraving are thicker than offset plates, of course, and the image is printed on the plate so that the type reads backwards.

After exposure, the image is inked and developed. From this point on, the photoengraving process is entirely different from that used in making offset plates. The inked image is sprinkled with resinous powder called "dragon's blood" and the plate is heated. The heat causes the powder to melt and combine with the ink to form an acid resist. The plate is then put into an etching tank which sprays acid against its surface. The image areas are protected by the acid-resistant coating, while the nonprinting areas are etched away.



57.676X

Figure 17-44.—Built-in bottom gage pins.

As the acid eats into the metal, the sides of the dots or lines must be covered with the dragon's blood to prevent the acid from undercutting the image. Therefore the plate is removed from the etching tank after a few minutes, washed free of acid, and the sides of the image are powdered with dragon's blood, and the plate is reheated.

After this, the plate is put back into the etching tank and etched again. This powdering and etching operation is continued until the background is etched to the desired depth, leaving the image standing in relief.

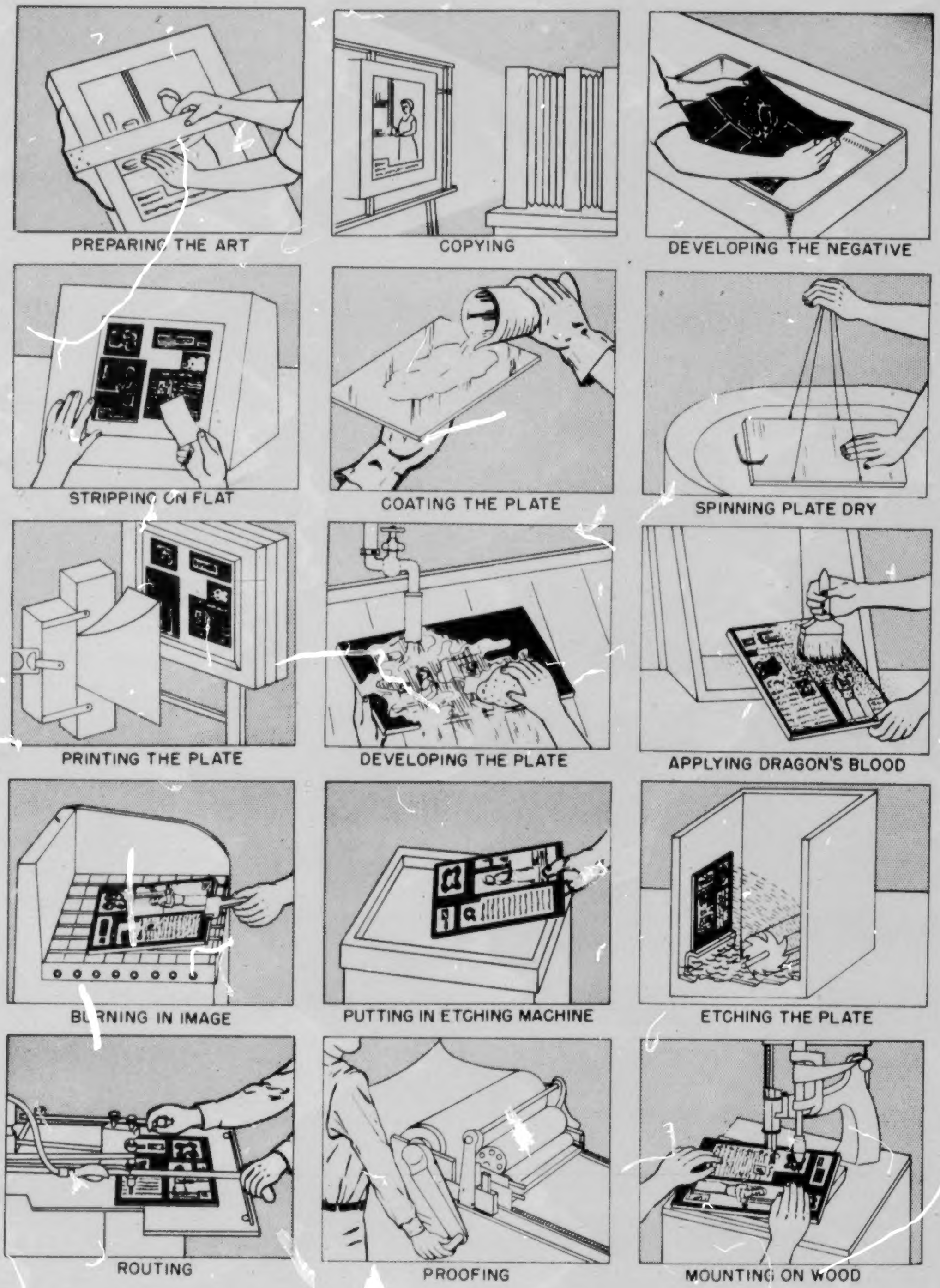
After etching is completed, the plate is subjected to a number of finishing operations, such as re-etching, and hand tooling. Most line cuts are also routed—that is, the metal in the non-printing areas is drilled or cut away so that it will not take ink and print as a dirty spot when the plate is put on the press. Plates may also be beveled and mounted on wood or metal base to make them type high.

Duplicate Plates

If the run is small, the printer generally prints directly from the original cuts, but if the run is extremely long, he may have duplicates made from the originals. He may do this to protect the original cut from wear or so that the job can be run two or more up and thus cut down press time. Duplicate plates are also required when a cut is to be distributed to a number of separate shops or offices.

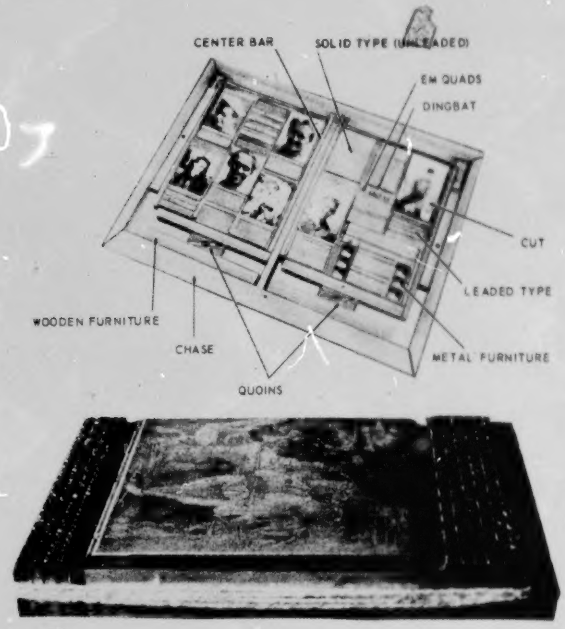
Stereotypes and electrotypes are the most common forms of duplicate plates, although plastic and rubber plates are also used. They may be made from cuts alone or from forms containing both type and cuts. (See fig. 17-46.)

Stereotypes are made by placing a sheet of blotter-like paper over the original cut and


PREPARING THE ART
COPYING
DEVELOPING THE NEGATIVE
STRIPPING ON FLAT
COATING THE PLATE
SPINNING PLATE DRY
PRINTING THE PLATE
DEVELOPING THE PLATE
APPLYING DRAGON'S BLOOD
BURNING IN IMAGE
PUTTING IN ETCHING MACHINE
ETCHING THE PLATE
ROUTING
PROOFING
MOUNTING ON WOOD

57.552

Figure 17-45.–Steps involved in making letterpress cut.



57.553

Figure 17-46.—Forms containing both type and cuts.

57.554

Figure 17-47.—Cut on left was used in making mat below. Stereotype on right was cast from mat.

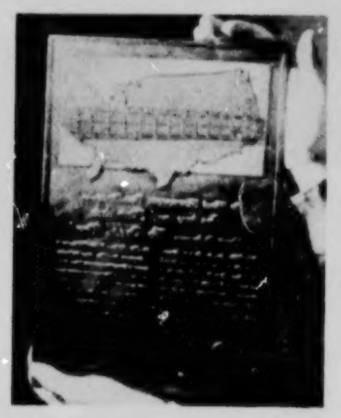
subjecting it to pressure in a special press. When the paper is removed, it carries an impression of the cut and is called a matrix or mat. (See fig. 17-47.) The mat is then placed in a device known as a casting box. The casting box is filled with hot metal and allowed to cool. The result is a stereotype cut. Stereotypes can be cast flat or curved, and they can be cast type-high or they can be cast on a thin base and mounted on metal or wood.

In making electrotypes, an impression of the original is made in wax or plastic. (See fig. 17-48.) This mold is then dusted with graphite and flowed with a solution of copper sulphate to which iron filings have been added. The iron reacts with the copper in the solution to form a thin coating which acts as an electrical conductor when the mold is placed in the electroplating solution.

The mold is next attached to a wire leading from the negative pole of a battery or an electric circuit, after which it is immersed in a vat containing a chemical plating solution. Another wire leading from the positive pole of the electrical source is attached to a copper plate which is placed at the other end of the vat. When the current is applied, the copper in the plate slowly passes into solution and deposits on the mold as a thin coating or shell.

When the shell reaches the proper thickness, it is removed from the vat and flowed with hot water. The heat melts the wax and frees the shell. Next, molten metal is flowed onto the back of the shell. Once this metal has cooled, the back is planed to the proper thickness and the electrotype is mounted on wood or beveled for mounting on a metal base. Electrotypes may be either flat or curved.

Stereotypes are seldom as good as the original because some of the detail is lost when the mat is made and also when the stereotype is cast. Electrotypes reproduce fine detail faithfully. Since stereotypes are made from relatively soft metal, they wear down with continued use. Electrotypes will last for many thousands of impressions because they have a very hard surface.



57.555X

Figure 17-48.—An electrotype plate.

Rubber and plastic plates are made by a process similar to that used in making stereotypes. A plastic matrix is made from the original cut and a duplicate plate consisting of hard rubber or thermosetting plastic is then made from this matrix in a special molding press.

RECENT DEVELOPMENTS

Magnesium is sometimes used instead of zinc or copper for making original plates, because it is lighter and etches much faster than the other metals. Magnesium plates are also used instead of stereotypes in some instances because they last longer and are relatively easy to produce.

Photoelectric Scanners are also making considerable headway in the printing industry in recent years. These scanning machines are used mostly for halftone work. The original copy is taped to a revolving cylinder where it is scanned by a photoelectric eye. As the cylinder revolves, the eye transmits light impressions to a heated electric needle. The needle burns the impressions into a plastic plate. The finished plate can be mounted on wood and used in direct printing or it can be used in making stereotypes and electros.

Some scanning machines are equipped to produce color separation plates from original colored copy. They will engrave on metal or they will produce positive copies on a thin, orange-coated plastic material. This orange-coated plastic may be used as a film positive for positive-working offset plates or it can be contact printed on film to produce a negative for negative-working plates.

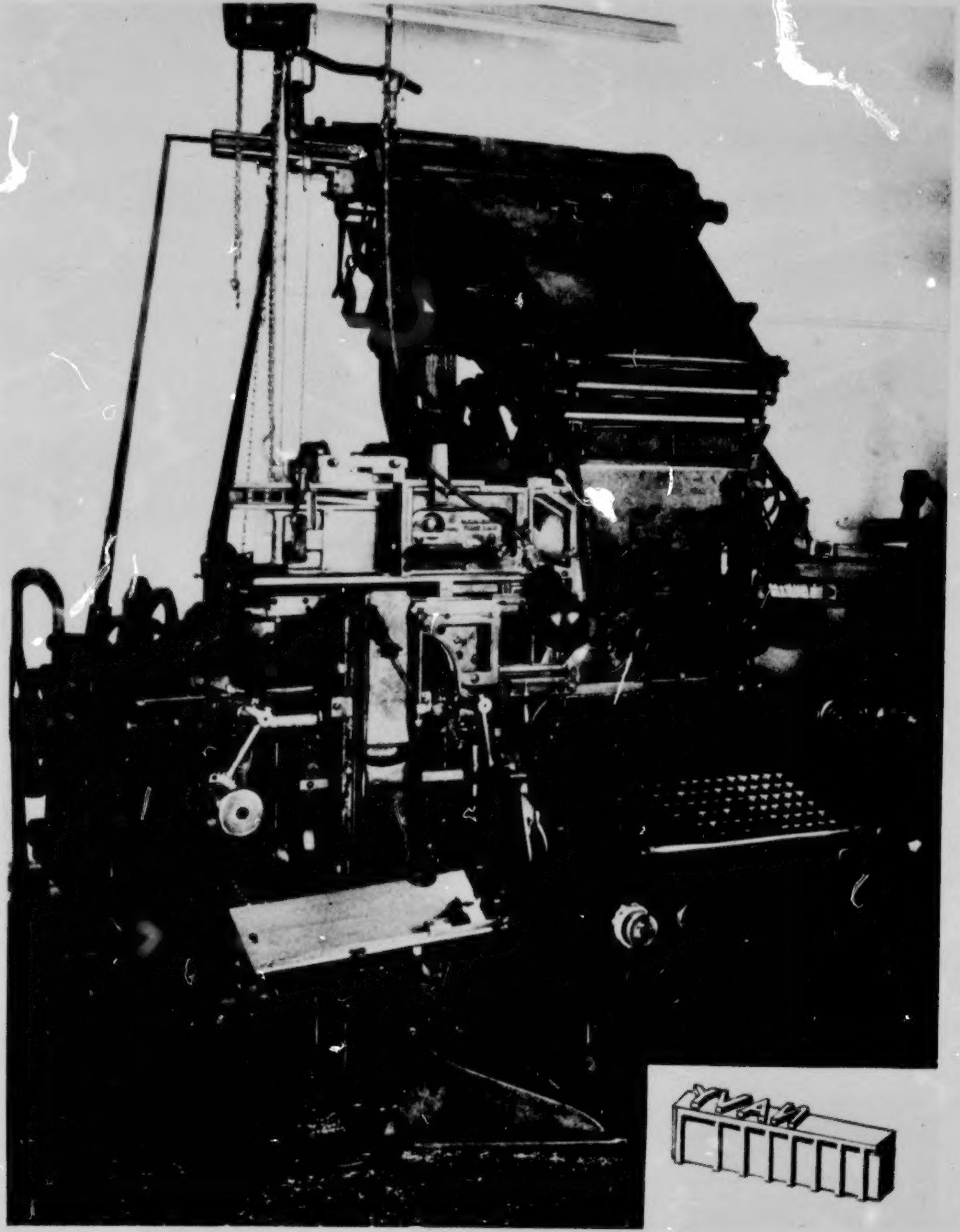
Dycril and similar plates are also used for letterpress printing. The platemaking process is similar to that described in chapter 10; however, a thicker plate is used and the image is etched deeper for letterpress printing. These plates may be either curved or flat and may be used on either flatbed or rotary letterpresses.

Typesetting Machines

Of course, all type is not set by hand. In large commercial plants, newspaper, book, and magazine copy—both text and headlines are set on typesetting machines, such as the Linotype and the Intertype. (See fig. 17-49.) These machines have a keyboard with separate keys for capital and lower case letters. When the operator presses a key, a small metal mold is released. These molds travel down a chute and assemble along two metal bars to form a line. When the line is full, the operator presses a lever that brings the molds into contact with molten metal. The metal cools amost immediately to form a continuous line, called a slug. These slugs are then assembled on galleys and proofed or printed in the same manner as handset type.

The Ludlow is another slug-casting machine. It is used chiefly for display or headline type. The operator sets individual brass molds by hand in a kind of frame, called a stick. When the line is full, he places the stick in a casting machine and brings molten metal into contact with the molds. The slug produced is similar to the Linotype slug.

There is still another kind of typecasting machine, known as the Monotype. This machine is operated by means of a keyboard which punches a tape. After the job is finished, the tape is run through a separate machine, called a caster. The punches in the tape actuate the caster, and lines of individual letters (similar to the type used for hand composition) are cast. Monotype composition is very useful for tabular work, such as railroad timetables and radio frequency charts. Since it casts lines of individ-



57.12

Figure 17-49.—Typesetting machine.

ual letters, rather than slugs, it is possible to make small changes by hand without resetting the entire line.

Linotype and Intertype machines can also be operated by tapes punched on a separate keyboard. You will learn more about tape-operated type-setting machines in just a minute.

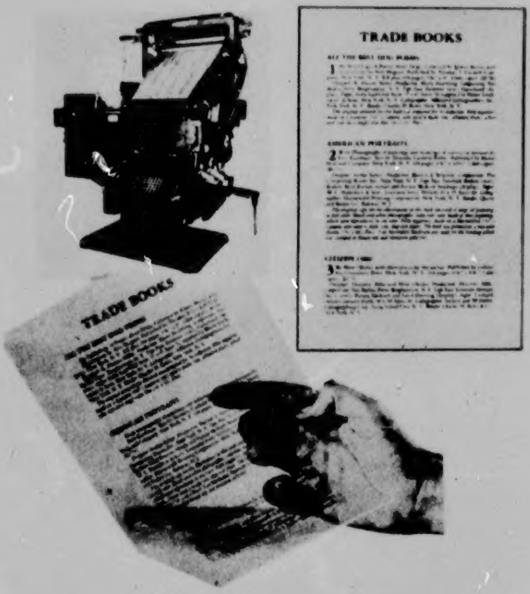
Phototypesetting Machines

The last two decades have seen the development of new types of machines which produce composition by photographic methods. The first phototypesetting machine, the Fotosetter, was built by Harris-Intertype in 1949. This machine, shown in figure 17-50, is similar in some respects to the Linotype and Intertype just discussed. When the operator presses the keys on the keyboard, photographic matrixes fall into plate to form a line–just as the brass molds are assembled in the regular slug-casting machine. These matrixes are similar to the molds used on the Linotype and Intertype except that instead of a mold, each carries a small film negative of the character it represents.

When the line is full, the operator presses a lever that starts the photographic assembly operating and the matrixes are moved into place over a piece of film or photographic paper and the exposure is made. As each line is photographed, the film or paper is advanced the proper distance in the machine. When the job is complete, the film or paper is developed and used for reproduction proofs or as a negative for printing directly on offset plates.

The Harris-Intertype Company later developed the Fotomatic, a tape-operated model of the Fotosetter, and the Fototronic type setter, which is a tape-operated disk machine. You will learn more about disk-operated machines in just a minute.

Other phototypesetting machines include the Monophoto Filmsetter which operates with a Monotype keyboard and a separate photographic unit, and the Photon, Linofilm, ATF Typesetter, Megatype, Alphatype, and the AM 725 Phototypesetting Machine which operates with a keyboard similar to that of an electric typewriter. On most of these machines, the compositor uses the keyboard to produce a punched paper or magnetic tape. This tape is then fed through a photographic unit to produce the finished product.



57.13X

Figure 17-50.–Phototypesetting machine and work produced on it.

The Photon is a good example of a disk-operated machine. It was developed in the 1950's. Each disk contains sixteen 90-character fonts and each character can be enlarged or reduced to produce a variety of type sizes ranging from 5 to 72 point. The disk revolves as the composition is set to bring the proper characters into exposure position. A strobe light and lenses are used to project the characters onto film or paper. The latest Photon machines are capable of setting as many as 500 characters a second. They can be operated with a manual keyboard control or computer-generated tapes.

Use of Computers

The most recent trend is toward the use of computers in the composing room. Text matter is typed on an electric typewriter which produces a rough typed copy and punches a tape at the same time. Type faces, spacing, indentions, and other printer's instructions are coded into the tape as the copy is typed.

The typed copy is read for errors or the material is run through a computer and the computer "readout" is checked. The operator then types a correction tape, using a prearranged code to indicate where the corrections are to be made. This correction tape is spliced to the front of the original tape and both tapes are fed into an electronic computer at the rate of more than 1,000 characters per second.

The computer automatically incorporates all editing changes, counts the characters and keeps track of the number of spaces in each line, adding to or deleting space from between the words so that all lines will come out even (justified) along the right margin. The computer also decides where to split words which must be hyphenated at the ends of lines and produces a final tape (either paper or magnetic) for use in an automatic typesetting machine, such as the Linotype or Intertype or in a phototypesetting machine, such as the Photon.

In order to make fuller use of the speed of the computer, new typesetting machines are being developed which utilize a cathode ray tube similar to a television tube. The tube generates images of the characters which are then projected through lenses onto photographic paper or film, at possible speed ranges of up to 100,000 characters per second.

RCA has developed a completely electronic typesetter called the Videocomp, and the Mergenthaler Linotype Company working jointly with CBS has developed a machine called the Linotron. This machine is capable of laying out and setting complete book pages at speeds of 1,000 to 2,000 characters per second. It would be possible to set the page you are now reading, for example, in less than 3 seconds, and this complete book could be set in approximately 15 minutes.

The 3M Company's Electron Beam Recorder utilizes a dry silver process which can be duplicated in conventional photographic film for microfilm output or subsequent hard copy and plate production. Smith-Corona's SC-4060 combines a character matrix generator and a vector generator which allows special characters and illustrations to be reproduced along with the typeset material. Both the SC-4060 and the EBR allow for the rotation of the image when it is desirable to run it broad on the page.

Other companies working in the cathode ray tube (CRT) field include Harris-Intertype, Fairchild, Motorola, and IBM. Users of these new typesetting machines include publishers of newspapers, directories, catalogs, compilations, and books. Because of their costs, they have not made inroads into smaller publishing and printing companies; however, composition service centers are being established in some areas to provide trade composition for smaller printing plants.

OPTICAL SCANNERS

Optical scanners, such as the Compuscan 170, are used by some publishing firms to prepare tapes for driving the typesetting equipment. These scanners can produce a tape directly from typed (or printed) manuscript and it is not necessary for the operator to keyboard it. They produce paper or magnetic tape or interface directly to a computer system.

The Navy's Rate Training Manual, *Seaman*, NavPers 10120-F, is an example of a book produced by optical scanner.

•

CHAPTER 18

SHOP ADMINISTRATION

As you have seen in chapter 1, duty assignments or Lithographers are varied. They range from the large plant ashore with a 30-man complement to a 1- or 2-man shop aboard ship. So naturally your duties and responsibilities as an LI 3 or LI 2 at various duty stations will also vary.

At the large shore plant the duties of administration and management normally are assumed by a senior petty officer, probably a CPO. You will be assigned to a specific work area such as the press room or the darkroom. But if you are stationed aboard ship or on shore duty where the print shop is relatively small, you may be the leading lithographer. The shop administration duties will then be your responsibility.

It is impossible to cover all the information which you will need to know to perform the duties of a leading lithographer in this chapter. However, by studying the material presented here you should develop a broad understanding of what is required to organize and manage a Navy print shop effectively.

RULES AND REGULATIONS

The basic rules and regulations covering all printing in the Federal government are formulated by the Joint Committee on Printing (JCP). This Congressional Committee is composed of three members of the Senate and three members of the House of Representatives. It deals with all areas of Government printing and periodically reviews and revises its regulations as technological advances within the trade occur and Government policy changes. The Committee's regulations are issued in a booklet called *Government Printing and Binding Regulations.* (See fig. 18-1.)

Since the JCP Regulations pertain to all Government printing, they do not reflect certain specific policies and regulations peculiar to the Navy. For this reason the Navy publishes another set of regulations titled *Department of the Navy Publications and Printing Regulations*, NAVEXOS P-35. (See fig. 18-2.) Such matters as the establishment of printing facilities, equipment procurement, the purchase of printing through commercial sources, and ship or station newspapers are covered by these regulations. Changes and revisions are periodically issued by the Administrative Assistant of the Secretary of the Navy's Office. At the time of this writing, the regulations are undergoing an extensive update and revision.

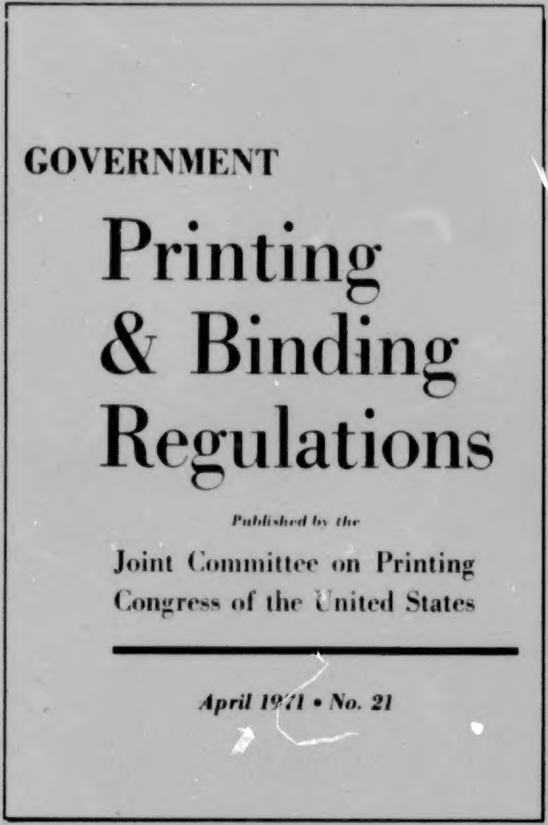
INSTRUCTIONS AND NOTICES

Navy instructions and notices which pertain directly to printing are numbered in the 5600 series. They are issued by various offices and bureaus of the Department of the Navy that are responsible in specific areas dealing with printing matters. Normally all instructions and notices are retained by the administrative office of each command. All 5600 instructions and notices should be routed to the print shop and a copy of each should be retained for the shop files.

You should be aware of all pertinent instructions and notices of the 5600 series. *The Consolidated Subject Index of Unclassified Instructions,* NAVPUBINST 5215.4, contains an alphabetical listing of all instructions. Check through this index and its supplements at regular intervals and order any instructions that have not yet been received by your command.

NAVAL PUBLICATIONS AND PRINTING SERVICE

As set forth in Department of the *Navy Publications and Printing Regulations,*



GOVERNMENT

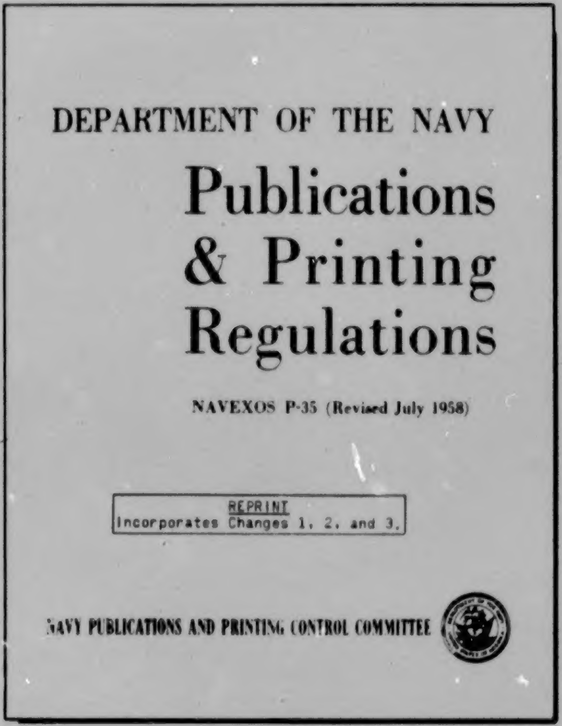
Printing
& Binding
Regulations

Published by the

Joint Committee on Printing
Congress of the United States

April 1971 • No. 21

57.764
Figure 18-1.—Government Printing and Binding Regulations.



DEPARTMENT OF THE NAVY

Publications
& Printing
Regulations

NAVEXOS P-35 (Revised July 1958)

REPRINT
Incorporates Changes 1, 2, and 3.

NAVY PUBLICATIONS AND PRINTING CONTROL COMMITTEE

57.765
Figure 18-2.—Department of the Navy Publications and Printing Regulations, NAVEXOS P-35.

NAVEXOS P-35, The Navy Publications and Printing Service (NPPS) exercises technical direction over the Navy's printing facilities, including those aboard ship.

As part of its Shipboard Printing Plant Program, NPPS assists the fleet in such matters as:

1. The establishment or disestablishment of shipboard printing plants.
2. The addition or deletion of equipment on allowance lists.
3. Replacement or disposal of obsolete and unrepairable equipment.
4. Providing recommendations as to the design of new, and modernization of old, printing plants aboard ship.

Another service available through branch offices of the Navy Publications and Printing Service is the informal training of Navy Lithographers on specific equipment or procedures. Arrangements for training can be made by contacting the Director of the NPPS organization in your area.

Shipboard Inventory Report

As outlined in NAVSUPINST 5600.16A each ship with an authorized printing plant shall maintain a working copy of JCP Form No. 5, Annual Plant Inventory. This form provides an equipment status of the ship's printing equipment.

When requesting new equipment to replace existing equipment, or to obtain additional equipment for your shop, your ship must submit to NPPS a letter request with complete narrative justification for the proposed purchase, rental, transfer, or disposal of the equipment concerned.

NPPS reviews all ship and Type Commander requests for items of printing, binding, and related or auxiliary equipment. If the request is adequately justified, NPPS obtains necessary authorization and forwards approval of the proposed transactions via the cognizant Type Commander to the commanding officer concerned along with disposition instructions for the old equipment. As soon as the transaction has been completed, the ship submits a letter report containing the make, model, serial number, and purchase price of the acquired equipment to the Director, Navy Printing and Publications Service, Washington, D.C. 20390. NPPS will then update the equipment inventory maintained there. The change is also recorded on the ship's working copy of JCP Form No. 5. A sample inventory form is shown in fig. 18-3.

HANDLING CLASSIFIED MATERIAL

A Navy Lithographer handles material which must be safeguarded in accordance with security regulations. The latest security regulations are set forth in two publications: *Information Security Program Regulation*, July 1972, DOD 5200.1-R and the *Department of the Navy Supplement to the DOD Information Security Program Regulation*, OPNAV Instruction 5510.1D. (See fig. 18-4.)

You alone are responsible for any violation of security that you deliberately or unintentionally commit. For this reason, you must be thoroughly familiar with the contents of the security regulations. A brief explanation and definition of security terms follows.

PURPOSE OF SECURITY PROGRAM

The security program deals basically with the safeguarding of information that should not be allowed to fall into the hands of foreign governments or foreign nationals because of the danger that such information might be used to the detriment of the United States.

Information may be compromised through careless talk, improper handling of classified material, and in various other ways. Some of the ways in which military personnel may accidentally give away vital information are discussed in *Basic Military Requirements*, NAVTRA 10054.

SECURITY PRINCIPLES

The Department of Defense security formula is based on the premise of circulation control; i.e., the control of dissemination of classified information. According to this policy, knowledge of possession of classified security information is permitted only to persons whose official duties require access in the interest of promoting national security and only if they are determined to be trustworthy.

DEFINITIONS OF SECURITY TERMS

The following definitions are presented to assist you in understanding certain terms used in connection with security.

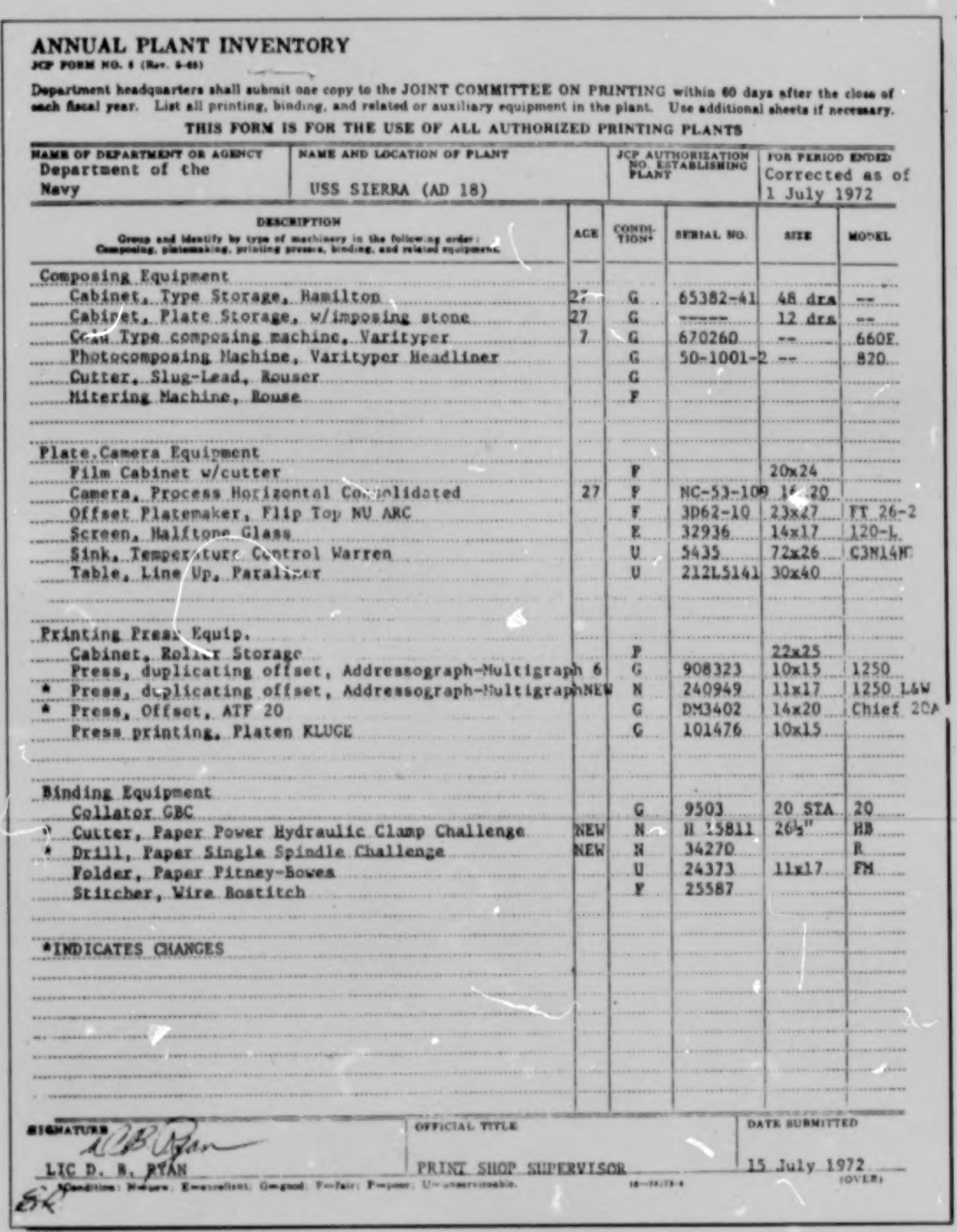
ACCESS–The ability and opportunity to obtain knowledge or possession of classified material.

CLASSIFICATION–The determination that official information requires, in the interest of national security, a specific degree of protection against unauthorized disclosure, coupled with a marking or other identification signifying that such a determination has been made.

CLASSIFIED INFORMATION–Any matter, document, product, or substance on or in which classified information is recorded or embodied.

CLEARANCE–An administrative determination by competent authority that an individual is eligible, from a security standpoint, for access to classified information of a specified category.

COMPROMISE–A loss of security which results from an unauthorized person obtaining



ANNUAL PLANT INVENTORY
JCP FORM NO. 5 (Rev. 6-65)

Department headquarters shall submit one copy to the JOINT COMMITTEE ON PRINTING within 60 days after the close of each fiscal year. List all printing, binding, and related or auxiliary equipment in the plant. Use additional sheets if necessary.

THIS FORM IS FOR THE USE OF ALL AUTHORIZED PRINTING PLANTS

NAME OF DEPARTMENT OR AGENCY	NAME AND LOCATION OF PLANT	JCP AUTHORIZATION NO. ESTABLISHING PLANT	FOR PERIOD ENDED
Department of the Navy	USS SIERRA (AD 18)		Corrected as of 1 July 1972

DESCRIPTION Group and identify by type of machinery in the following order: Composing, platemaking, printing presses, binding, and related equipment.	AGE	CONDITION*	SERIAL NO.	SIZE	MODEL
Composing Equipment					
Cabinet, Type Storage, Hamilton	27	G	65382-41	48 drs	--
Cabinet, Plate Storage, w/imposing stone	27	G	-----	12 drs	--
Cold Type composing machine, Varityper	7	G	670260	--	660E
Photocomposing Machine, Varityper Headliner		G	50-1001-2	--	820
Cutter, Slug-Lead, Rouser		G			
Mitering Machine, Rouse		F			
Plate.Camera Equipment					
Film Cabinet w/cutter		F		20x24	
Camera, Process Horizontal Consolidated	27	F	NC-53-109	16x20	
Offset Platemaker, Flip Top NU ARC		F	3D62-10	23x27	FT 26-2
Screen, Halftone Glass		E	32936	14x17	120-L
Sink, Temperature Control Warren		U	5435	72x26	C3N14N
Table, Line Up, Paraliner		U	212L5141	30x40	
Printing Press Equip.					
Cabinet, Roller Storage		P		22x25	
Press, duplicating offset, Addressograph-Multigraph	6	G	908323	10x15	1250
* Press, duplicating offset, Addressograph-Multigraph	NEW	N	240949	11x17	1250 L&W
* Press, Offset, ATF 20		G	DM3402	14x20	Chief 20A
Press printing, Platen KLUGE		G	101476	10x15	
Binding Equipment					
Collator GBC		G	9503	20 STA	20
* Cutter, Paper Power Hydraulic Clamp Challenge	NEW	N	H 25811	26½"	HB
* Drill, Paper Single Spindle Challenge	NEW	N	34270		R
Folder, Paper Pitney-Bowes		U	24373	11x17	FM
Stitcher, Wire Bostitch		F	25587		
*INDICATES CHANGES					

SIGNATURE	OFFICIAL TITLE	DATE SUBMITTED
D B Ryan LIC D. B. RYAN	PRINT SHOP SUPERVISOR	15 July 1972

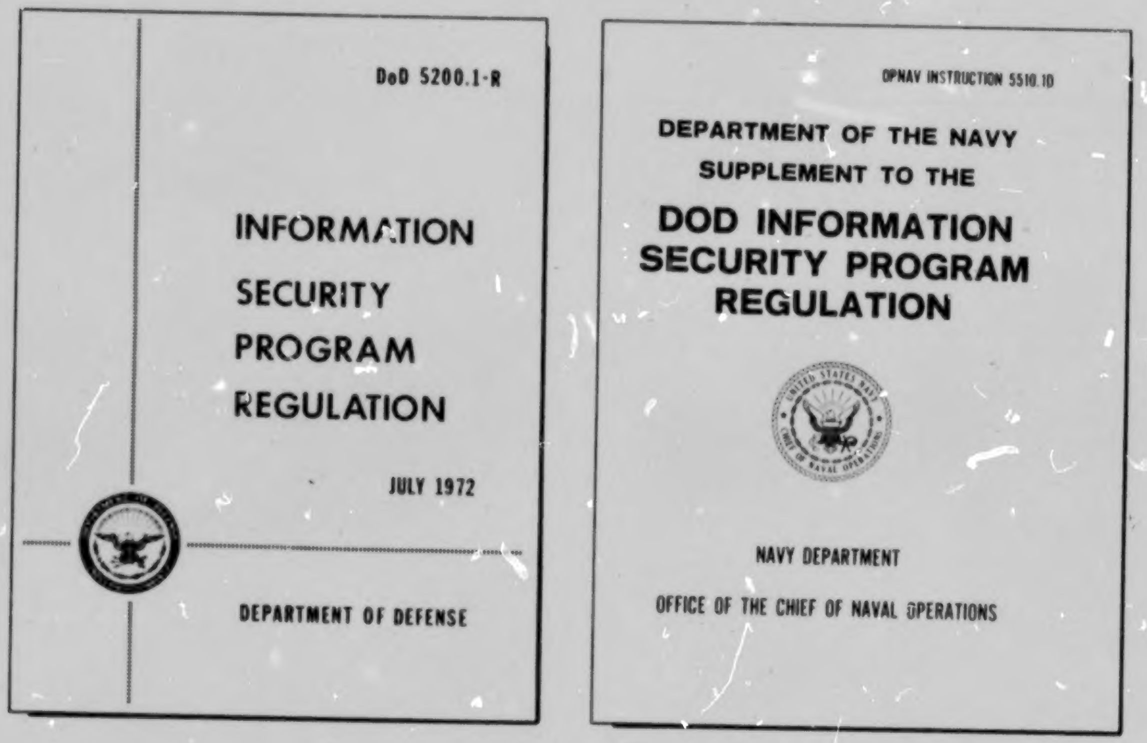
*Condition: N=new; E=excellent; G=good; F=fair; P=poor; U=unserviceable.

(OVER)

SR

57.766

Figure 18-3.—Plant inventory form.



DoD 5200.1-R

INFORMATION
SECURITY
PROGRAM
REGULATION

JULY 1972

DEPARTMENT OF DEFENSE

OPNAV INSTRUCTION 5510.1D

DEPARTMENT OF THE NAVY
SUPPLEMENT TO THE
DOD INFORMATION
SECURITY PROGRAM
REGULATION

NAVY DEPARTMENT

OFFICE OF THE CHIEF OF NAVAL OPERATIONS

57.767

Figure 18-4.—All regulations concerning classified matter are found in these two publications.

knowledge of classified information. The term "unauthorized person" means any person not authorized to have access to classified information.

CUSTODIAN—An individual who has possession of or is otherwise charged with the responsibility for safeguarding and accounting for classified information.

DECLASSIFICATION—The determination that classified information no longer requires, in the interest of national security, any degree of protection against unauthorized disclosure, coupled with a removal or cancellation of the classification designation.

DISCLOSURE—As it relates to classified information, an officially authorized release or dissemination by competent authority whereby the information is furnished to a specific individual group, or activity.

MARKING—The physical act of indicating on classified material the assigned classification, changes in classification, the classifier, the declassification date, and any limitations on the use thereof.

NEED TO KNOW—The term given to the requirement that the dissemination of classified information be limited strictly to those persons whose official military or other governmental duties require knowledge or possession thereof. Responsibility for determining whether a person's duties require that he possess or have access to classified information and whether he is authorized to receive it rests upon each individual who has possession, knowledge, or command control of the information involved and not upon the prospective recipient. This principle is applicable whether the prospective contractor is another Federal agency, or a foreign government. A "need to know" is recognized as established when ALL the following conditions exist: the disclosure is necessary in the interest of national security; there clearly appears from the position, status, duties, and responsibilities of the applicant that he has a legitimate requirement for access to the classified information in order to carry out his assigned duties and responsibilities; there is no other equal or ready source of the same classified information available to him; and the applicant is or can be appropriately cleared for access to the degree of classified information involved and is capable both physically and mentally of providing the degree of protection which that information requires.

STOWAGE—"Stowage" refers to the manner in which classified material is protected by physical or mechanical means.

SECURITY AREAS

Spaces containing classified matter are known as security areas. These security (or sensitive) areas have varying degrees of security interest, depending upon their purpose and the nature of the work and information or materials concerned. Consequently, the restrictions, controls, and protective measures required vary according to the degree of security importance. To meet different levels of security sensitivity, there are three types of security areas; all areas are clearly marked by signs reading "SECURITY AREA—KEEP OUT. AUTHORIZED PERSONNEL ONLY."

EXCLUSIVE AREA

Spaces requiring the strictest control of access are designated EXCLUSION AREAS and are so marked. They contain classified matter of such nature that, for all practical purposes, admittance to the area permits access to the material.

An exclusion area is fully enclosed by a perimeter barrier of solid construction. Exists and entrances are guarded, or secured and alarm protected, and only those persons whose duties require access and who possess appropriate security clearances are authorized to enter.

LIMITED AREA

A limited area is one in which the uncontrolled movement of personnel permits access to the classified information therein. Within the area, access may be prevented by escort and other internal controls.

The area is enclosed by a clearly defined perimeter barrier. Entrances and exits are either guarded, controlled by attendants to check personal identification, or under alarm protection.

Operating and maintenance personnel who require freedom of movement within a limited area must have a proper security clearance. The commanding officer may, however, authorize entrance of persons who do not have clearances. In such instances, escorts or attendants and other security precautions must be used to prevent access to classified information located within the area. Combat Information Center is classified a limited area.

CONTROLLED AREA

A controlled area does not contain classified information. It serves as a buffer zone to provide greater administrative control and protection for the limited or exclusion areas. Thus, passageways or spaces surrounding or adjacent to limited or exclusion areas may be designated and marked controlled areas.

Controlled areas require personnel identification and control systems adequate to limit admittance to those having bona fide need for access to the area.

CLASSIFICATION CATEGORIES

Official information which requires protection in the interest of national defense is classified under one of three categories: Top Secret, Secret, and Confidential. No information may be withheld or classified, if otherwise releasable, simply because such information might reveal an error, inefficiency, or might be embarrassing.

TOP SECRET

Use of the classification Top Secret is limited to defense information or material which requires the highest degree of protection. Top Secret is applied only to information or material, the unauthorized disclosure of which could result in EXCEPTIONALLY GRAVE DAMAGE to the nation, and could:

1. Lead to a break in diplomatic relations, armed attack on the United States or its allies, or a war.
2. Compromise military plans or scientific or technological developments vital to the national defense.

SECRET

Use of the classification Secret is limited to defense information or material, the unauthorized disclosure of which could result in SERIOUS DAMAGE to the nation, and could:

1. Jeopardize the international relations of the United States.
2. Endanger the effectiveness of a program or policy vital to the national defense.
3. Compromise important military or defense plans, or scientific or technological developments important to national defense.
4. Reveal important intelligence operations.

CONFIDENTIAL

Use of the classification Confidential is limited to defense information or material, the unauthorized disclosure of which could result in DAMAGE to the nation.

SPECIAL MARKINGS

In addition to the security labels mentioned already, other markings also appear on classified material. Among these markings are such designations as "Restricted Data" and "For Official Use Only."

Restricted Data

All data concerned with (1) design, manufacture, or utilization of atomic weapons, (2) production of special nuclear material, or (3) use of special nuclear material in production of energy bear conspicious "Restricted Data" markings. Restricted data, when declassified under the Atomic Energy Act of 1954, must be marked "Formerly Restricted Data, Handle as Restricted Data in Foreign Dissemination, Section 144b, Atomic Energy Act, 1954."

For Official Use Only

The term "For Official Use Only" (FOUO) is assigned to official information that requires some protection for the good of the public interest but is not safeguarded by classifications used in the interest of national defense.

PREPARATION AND MARKING

Each document or material is classified according to the importance of the information it contains or reveals. It is important to identify individually items of information which require protection and then to consider whether compromise of the document or material as a whole would create a greater degree of damage than compromise of the items individually. The classification of the document or material must be the classification that provides protection for the highest classified item of information or for the document or material as a whole, whichever is higher.

The purpose of markings required for classified material serves to record the proper classification, to inform recipients of the assigned classification, to indicate the level of protection required, to indicate the information that must be withheld from unauthorized persons, to provide a basis for derivative classification, and to facilitate downgrading and declassification actions.

Upon assignment of a classification category to information, it is immediately marked clearly and conspicuously on all documents.

On documents the classification marking of TOP SECRET, SECRET, or CONFIDENTIAL is stamped, printed, or written in capital letters that are larger than those in the text or the document. The marking is mandatory in addition to the typed or printed designation required by the *Correspondence Manual.* When practicable, the markings are red in color. On other types of material, the classification marking is stamped, printed, written, painted, or affixed by means of a tag, sticker, decal, or similar device in a conspicuous manner. If marking is not physically possible on the material, written notice of the assigned classification is provided to recipients of the material.

CUSTODY

STORAGE

Commanding Officers are directly responsible for safeguarding all classified material and for establishing measures for the inspection of safe-storage containers and areas where classified material is kept to insure compliance with security regulations. The term Commanding Officer is intended to include "competent authority," "commander," "officer in charge," "naval representative," "director," "inspector," and any other title assigned to an individual, military or civilian, who, through position or status, is qualified to assume responsibility and render decisions.

Numerical Evaluation System

A system has been developed for the purpose of providing a uniform guide for establishing security protection of classified material in storage that is equal in value to the classification of that material. This system does not guarantee protection, nor does it attempt to meet every conceivable situation, but with a commonsense approach it is possible to obtain a satisfactory degree of security with a minimum of sacrifice in operating efficiency.

This system is called the Numerical Evaluation System. It contains two elements: (1) a Table of Numerical Equivalents which assigns numerical values for various types of storage areas, containers, and guarding an alarm systems which by themselves or together may be used in the security program for the protection of classified material; and (2) an Evaluation Graph which establishes, in the form of numerical values, minimum levels of security required for protection of classified material based on its classification, the quantity, and the scope of the material.

Combinations

In keeping with the Navy's security principle of "need to know," it is essential that combinations to locks of classified containers be known only to those who actually control the classified material. Also, a record of combinations shall be sealed in an envelope and kept on file by the person designated by the Commanding Officer.

When selecting combinations, personal data such as birth dates and serial numbers, multiples of 5, and simple ascending or descending arithmetic series should be avoided. A combination should never be used for more than one container in any one component.

When securing dial combination locks, the dial should be rotated at least four complete turns in the same direction. The drawers of safes and cabinets should be checked to assure they are held firmly in the locked position.

CUSTODIANS

Custodians of classified material are responsible for providing protection and accountability for that material at all times, and for locking classified material in appropriate security equipment whenever the material is not in use or under direct surveillance of authorized persons.

Classified material should not be removed from working areas for the purpose of working on such material during off-duty hours, or for any other purpose that involves personal convenience. However, when classified material is removed from the physical confines of the command, as when it is taken to a conference or other local areas, a complete list shall be prepared by the individual removing the material. This list should be filed in accordance with local directives.

Emergency Planning

Plans must be developed by each command for the protection, removal, or destruction of classified material in case of natural disaster, civil disturbance, or enemy action. Such plans shall establish detailed procedures and responsibilities for the protection of classified material so that it does not fall into unauthorized hands in the event of an emergency, and shall indicate what material is to be guarded, removed, or destroyed. An adequate emergency plan provides for: guarding the material; removing the classified material from the area; complete destruction of the classified material on a phased, priority basis; or any combination of these actions. However, reducing the amount of classified material on hand, and maintaining only current and necessary material, can be the most effective step toward planning for an emergency situation.

Emergency plans should provide for the protection of classified information in a manner which will minimize the risks of loss of life or injury to personnel.

Accountability

Except for publications containing a distribution list by copy number, all copies of Top Secret documents must be serially numbered at the time of origination, in the following manner: "Copy No.__of__copies."

Top Secret documents shall contain a list of effective pages; this list should include a Record of Page Checks. When this is impractical, as in correspondence or messages, the pages shall be numbered as follows: "Page__of__pages."

Commanding officers establish administrative procedures for recording all Secret material originated and received, and maintain a receipting system for all Secret material distributed or routed to activities outside their commands. As a general rule, Secret materials are also serially numbered.

Commanding officers also provide accountability for all Confidential materials originated or received by their commands.

ACCESS AND DISSEMINATION

Eligibility Standards

Personnel whose work requires access to classified material must be granted an appropriate clearance. The standards for the various levels of clearances are different, but they all follow a basic format for both civilian and military personnel. Essentially, the standards are that no person shall be permitted knowledge of, possession of, or access to classified material solely by virtue of rank, position, or security clearance. Clearance serves to indicate that the persons concerned are eligible for access to classified material should their official duties so require, and no person will be granted a security clearance unless it has been determined that the clearance is in keeping with the interests of national security.

Any person authorized access to classified information must be considered to be loyal, of good character, of good integrity, trustworthy, and of such habits and associations as to indicate good discretion or judgment in the handling of classified information.

The ultimate determination of whether the granting of a clearance is in keeping with the interests of national security must be an overall determination based on all available information. Personal data, both past and present, that are investigated and considered before granting a clearance include: Any criminal, infamous, dishonest, or notoriously disgraceful conduct; habitual excessive use of intoxicants; drug abuse; sexual perversion; and any excessive indebtedness, recurring financial difficulties, unexplained affluence, or repetitive absences without leave which furnish reason to believe that the individual may act contrary to the best interest of national security.

Security Clearance

A personnel security clearance requires an administrative investigation by competent authority and certifies that the person is eligible for access to classified material of the same or lower category as the clearance being granted. Security clearances are of two types:

1. Final clearance—one granted upon completion of the required investigation.
2. Interim clearance—a temporary eligibility for access to classified information based on a lesser investigative requirement.

An interim clearance shall be issued only when it is clearly established that the delay while waiting for the completion of the investigation required for a final clearance would be harmful to the national interest. When interim clearance procedures are used, the investigation required for a final clearance must be initiated, and a final clearance shall be executed upon the satisfactory completion of the investigation, unless such clearance is no longer required.

Requirements for Security Clearance

The clearance requirements listed below are solely for military personnel.

TOP SECRET.—The investigative requirements for access to Top Secret material are:

1. Final clearance—a Background Investigation plus a records check by the issuing command; however, any person having a Top Secret clearance based on a National Agency Check prior to 1 Jan. 1973 with 15 years of continuous active duty does not require a Background Investigation.
2. Interim Clearance—a satisfactory completion of a National Agency Check.

SECRET.—For access to Secret material, a final clearance requires a National Agency Check plus a records check by the command. An interim clearance cannot be issued to personnel (1) with less than two consecutive years of active duty, (2) and until a name check has been made with the Defense Central Index of Investigations and with BuPers files.

CONFIDENTIAL.—No formal investigation is required for the issue of a Confidential clearance, provided a records check by the issuing command notes no derogatory information. An interim clearance for Confidential is not authorized.

TYPES OF PERSONNEL SECURITY INVESTIGATIONS

Personnel security investigations are of the following types:

1. National Agency Check.
   a. National Agency Check and Inquiry.
2. Background Investigation.

National Agency Check

A National Agency Check consists of a check with various Federal agencies for pertinent facts having a bearing on the loyalty and trustworthiness of the individual. The initial NAC conducted on inductees and first term enlistees does not include detailed technical fingerprint search, and is referred to as an ENT-NAC.

A National Agency Check and Inquiry (NACI) consists of a National Agency Check (described above) and Written Inquiries sent to law enforcement agencies, former employers, references, schools attended, etc., for pertinent facts which may have a bearing on the individual's suitability for Federal employment.

Background Investigation

A Background Investigation which is conducted for clearance purposes is designed to develop information as to whether the access to classified information by the person being investigated is clearly consistent with the interest of national security. It shall make inquiry into the pertinent facts bearing on the loyalty and trustworthiness of the individual. It normally covers the most recent 15 years of his life, or from the date of his 18th birthday, whichever is the shorter period. When derogatory information is developed in the course of any investigation, the investigation shall be extended to any part of the individual's life necessary to substantiate or disprove the information and to develop adequate information upon which to base a security determination. The investigation may also be expanded when additional investigation is specifically required by competent authority.

DESTRUCTION OF CLASSIFIED MATERIAL

Classified material not required by a command must not be allowed to accumulate but must either be turned in to the appropriate office or destroyed.

METHODS OF DESTRUCTION

Classified material shall be destroyed in the presence of appropriate officials by burning, melting, chemical decomposition, pulping, pulverizing, shredding, or mutilation sufficient to preclude recognition or reconstruction of the classified material.

During emergency situations at sea, classified material may be jettisoned at depths of 1,000 fathoms or more. If such water depth is not available, and if time does not permit other means of emergency destruction, the material should, nonetheless, be jettisoned to prevent its easy capture. When shipboard emergency destruction plans include jettisoning, document sinking bags should be available. If a vessel is to be sunk through intentional scuttling or is sinking due to hostile action, classified material should be locked in security filing cabinets or vaults and allowed to sink with the vessel rather than attempting jettisoning.

As a last resort, and when none of the methods previously mentioned can be employed, the use of other methods, such as dousing the classified material with a flammable liquid and igniting it, can be used as alternatives to certain loss of the material to the enemy.

The importance of beginning destruction sufficiently early to preclude loss of the material is of paramount importance and must be emphasized. The effects of premature destruction are considered relatively inconsequential when measured against the possibility of compromise. Classified material shall, when practicable, be marked in a manner to indicate its priority for emergency destruction.

RECORDS

Records of destruction are required for Top Secret and Secret material, and shall be dated and signed by two officials witnessing actual destruction; however, if the classified material was placed in burn bags the destruction record will be signed by the witnessing officials at the time the material was placed in the burn bags.

Persons witnessing the destruction of classified material shall:

1. Have a security clearance at least as high as the category of material being destroyed, and they shall be thoroughly familiar with the regulations and procedures for safeguarding classified information.
2. Observe the complete destruction of classified documents.
3. Check residue to determine that destruction is complete and reconstruction is impossible.
4. Take precautions to prevent classified material or burning portions of classified material from being carried away by wind or draft.

A record of destruction is not required for Confidential documents.

TYPES OF UNLAWFUL PRINTING

The laws of the United States place restrictions on the printing, duplicating or reproduction of paper money, postage and revenue stamps obligations, and securities of the United States and foreign governments and of certain licenses, certificates, copyrighted materials, and other official documents. In general, the following items should not be copied or reproduced:

1. Paper money.
2. Securities, including certificates of indebtedness, bonds, and bank notes.
3. Foreign currency.
4. Any other monetary instrument.
5. Postage stamps.
6. Citizenship certificates.
7. Bills of lading.
8. Identification papers, such as driver's licenses, etc.
9. Copyrighted materials (unless the copyright owner has given permission in writing for his materials to be reproduced).
10. Indecent or obscene materials.

Counterfeiting and Fraud

The Federal laws designed to prevent counterfeiting and fraud are found in Title 18 of the United States Code, which covers crimes. The laws clearly prohibit the reproduction of bonds, paper money, coins and metals issued as money, postage stamps, and other obligations or securities of the United States and those of foreign governments. The laws provide, however, that these items may be reproduced as illustrations for articles, books, albums, journals, newspapers, and films having a news, historical, collector's, or educational purpose. Such reproductions must be printed in black and white only (except for film, which may be in color). Postage stamps may be reproduced same size, but illustrations of paper money, bonds, and so on, must be reduced to 3/4 or enlarged to more than 1-1/2 times the size of the original. No individual facsimiles are permitted.

Several penalties are provided for violations of these laws.

COPYRIGHTED MATERIALS

In general, a copyright is a property right covering a musical, literary, or artistic production for a 28-year period. At the end of this period, the copyright owner may have the copyright renewed for an additional 28 years. After 56 years (28 years if the copyright is not renewed), the copyright expires and the work then falls into public domain. This means it belongs to the public and anyone can make any use of it. Government publications are generally within the public domain; however, some of them may contain copyrighted materials. For example, in this manual, you will find that some of the illustrations are reprinted with permission from copyrighted sources. (See the credit list in the front of the book.)

To be eligible for copyright, a book must (1) be published; (2) have a title (although the title is not subject to copyright); (3) carry a copyright notice and date; and (4) be reproduced for the purpose of sale or distribution. It may be bound, stitched, folded, typewritten, mimeographed, printed, or handwritten–provided it has been sold or distributed in one of these forms.

Copyrighted works must have a notice consisting of the word "Copyright" or the abbreviation "C" followed by the name of the copyright owner and the year in which the copyright was obtained. If the owner fails to include such a notice when he is printing or reprinting a work, the work is unprotected and falls into public domain. Of course, publication by another party without the owner's consent does not affect the copyright even if the notice is omitted.

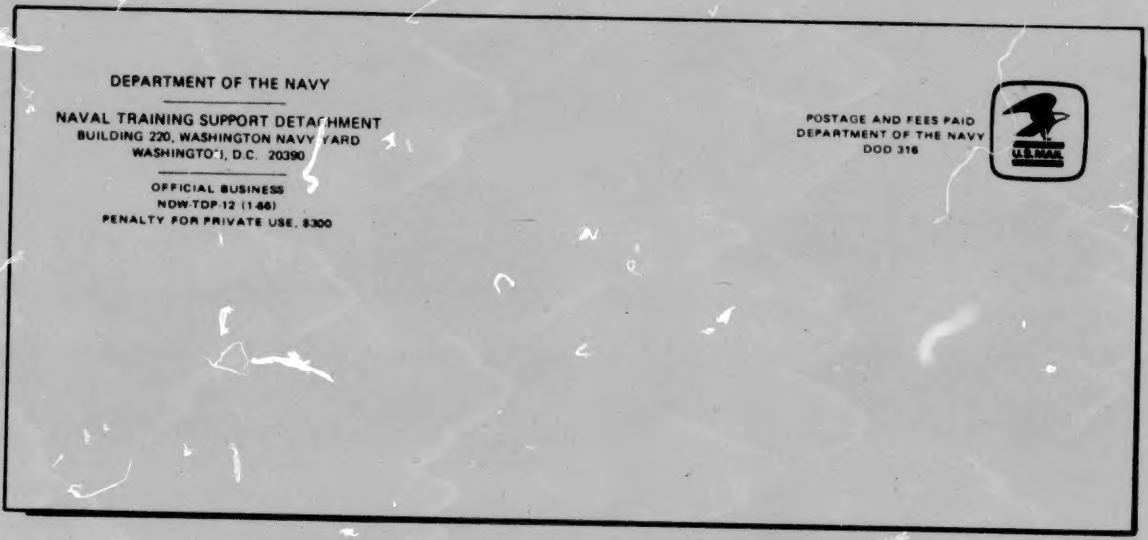
The infringement of a copyright is punishable by the award to the copyright owner of either the actual damages or statutory damages in the amount of not less than $250 and not more than $5000 for each violation. For further information on copyrights, refer to SECNAVINST 5870.1.

POSTAL PRINTING

Mail which is related exclusively to the business of the Navy Department or any other U.S. Government agency may be sent through the postal system without the actual payment of postage and fees. Instead, each envelope carries a "Postage and Fees Paid" inscription as shown in fig. 18-5. Known as indicia items, the inscriptions must be affixed to the envelope with a printing process. They cannot be handwritten or typewritten on the envelope.

The requirements for indicia items on letter size envelopes include the use of the eagle symbol shown in fig. 18-5. The eagle symbol is located in the upper right hand corner and shall be 13/16" X 13/16". No other size symbol is authorized. When the symbol is used on ordinary mail (non-airmail) it is positioned 3/8" from the top and 3/8" from the right edge. When the symbol is used on airmail with parallelogram stripes, it is positioned 1/2" from the top and right edges.

The use of the eagle symbol is not required on other than letter size mail. According to the U.S. Postal Service, letter size mail is defined as being at least 3" X 5" and not over 5 3/4" X 11 1/2".



DEPARTMENT OF THE NAVY

NAVAL TRAINING SUPPORT DETACHMENT
BUILDING 220, WASHINGTON NAVY YARD
WASHINGTON, D.C. 20390

OFFICIAL BUSINESS
NDW-TDP-12 (1-66)
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE NAVY
DOD 316

Figure 18-5.—Use of indicia items on an envelope. 6.1(57C)

In addition to the eagle symbol and inscription of the right side of official mail, an "Official Business" and "Penalty Statement" must be included on the left side. As you can see in fig. 18-5, this statement is printed in the return address area of the envelope.

Complete instructions governing the use of official mail indicia are found in Chapter 3, Section 2 of the *U.S. Navy Postal Instruction Manual*, OPNAVINST 2700.14.

RECORDS AND REPORTS

The amount of paperwork involved in your job will depend on your particular setup. In some shops, jobs are simply recorded in a control book when they are received and are logged out in the same book when they are delivered. A ledger, folder, or any similar record system may be used for this purpose.

The log should show the date the job comes in and the date it is delivered, as well as the length of the run, a description of the job, and the name of the office requesting it. (See fig. 18-6.)

Control Cards and Boards

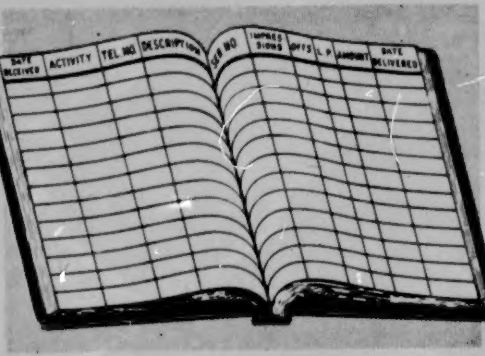
Some shops maintain a control card, like the one shown in figure 18-7 for each job. This card may be used in addition to or in place of the log. It enables you to check the progress of the work at any time.

A status board, similar to the one shown in fig. 18-8, is sometimes used in larger shops for work scheduling purposes and to provide an overall view of the shop's workload. Such a board usually shows the job number, the requestor, a brief description of the job, the percentage of completion, the date the job is due, and a remarks column to record any special information.

Regardless of which system you use, the important thing is to keep it simple, workable, and up-to-date.

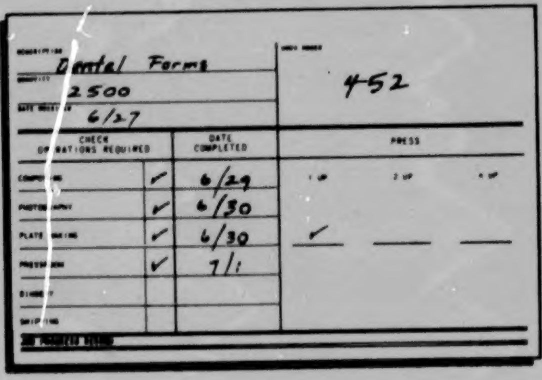
WORK REQUESTS

If your shop is aboard a cruiser, the chances are that you will be concerned only with work for your own ship, but if you are aboard a repair



113.261

Figure 18-6.—A ledger may be used for logging work in and out of the shop.



Dental Forms

2500

6/27

452

CHECK OPERATIONS REQUIRED		DATE COMPLETED
[illegible]	✓	6/29
[illegible]	✓	6/30
PLATE [illegible]	✓	6/30
[illegible]	✓	7/1
[illegible]		
[illegible]		

PRESS

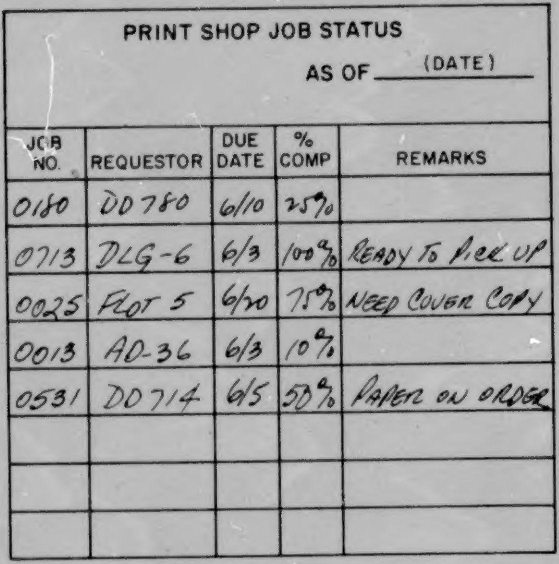
1 UP	2 UP	4 UP
✓		

113.262

Figure 18-7.—Control card.

ship or a carrier, you will probably do work for other ships as well as for your own.

Procedures for handling requests for printing vary from one type of ship to another. On some ships, all customer's requests must be approved by the repair officer; on others, requests are approved by the administrative officer or the ship's secretary. You should know your printing officer's policy on accepting work. If he requires that all requests be routed to the department head or other officers and offices concerned, you should make sure that all requests complete the routing.



PRINT SHOP JOB STATUS

AS OF (DATE)

JOB NO.	REQUESTOR	DUE DATE	% COMP	REMARKS
0180	DD 780	6/10	25%	
0713	DLG-6	6/3	100%	READY TO PICK UP
0025	FLOT 5	6/20	75%	NEED COVER COPY
0013	AD-36	6/3	10%	
0531	DD 714	6/5	50%	PAPER ON ORDER

57.768

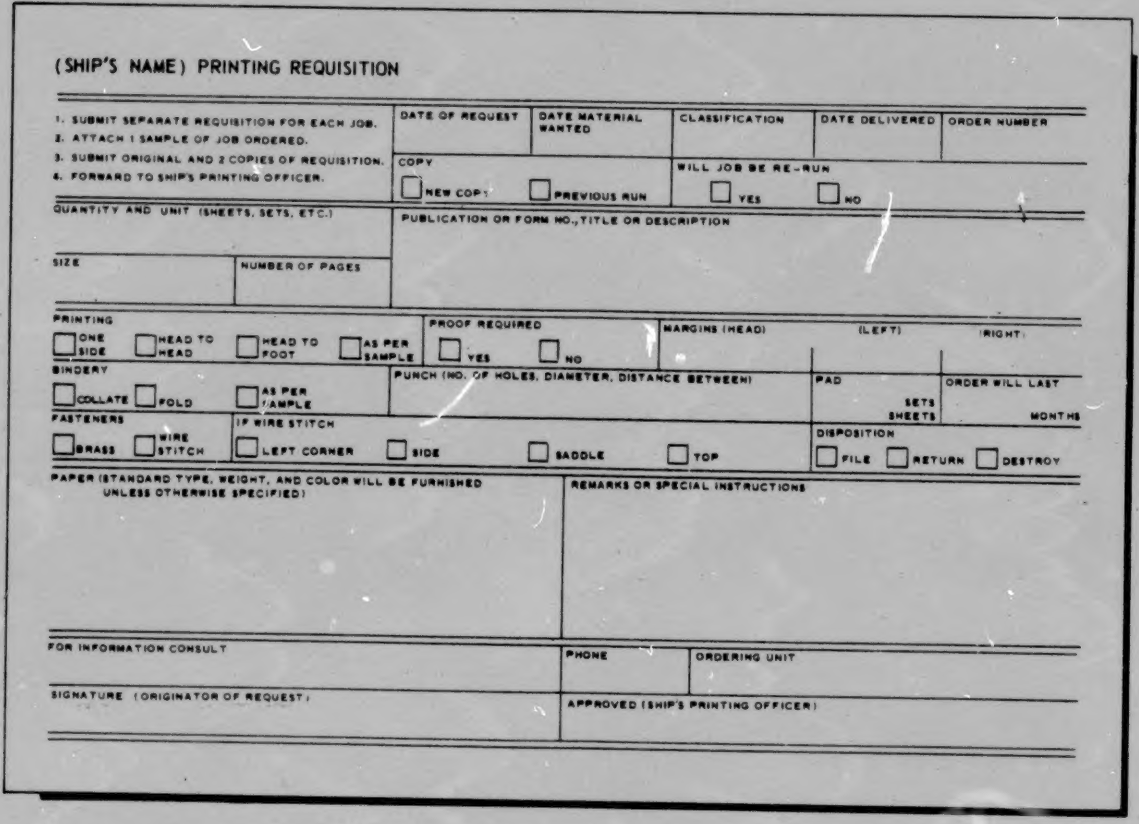
Figure 18-8.—Status board.

Be aware of the rules and regulations governing printing. If you receive a request for a job that you believe should not be printed in your shop, it is your responsibility to bring it to the attention of the printing officer and show him the authority (such as NavExos P-35, or some other official publication or instruction) on which you base your opinion.

The party requesting the printing may furnish you with a requisition, like that shown in figure 18-9, or the request may be submitted to you in the form of a memorandum or similar form. In any case, the form should supply instructions as to the size, quantity, color of ink, kind of stock, classification, and date needed.

You should check the instructions to see if they are complete and if all necessary copy has been furnished. In requesting information from a customer, remember to get as complete a picture as possible. It is better to get more information than you need than to end up with too little information.

Once you have obtained all the information needed, you should log the work request in and prepare a job worksheet or a work jacket similar to the one in figure 18-10. Worksheets are generally prepared in duplicate, one to be filed



(SHIP'S NAME) PRINTING REQUISITION

1. SUBMIT SEPARATE REQUISITION FOR EACH JOB.
2. ATTACH 1 SAMPLE OF JOB ORDERED.
3. SUBMIT ORIGINAL AND 2 COPIES OF REQUISITION.
4. FORWARD TO SHIP'S PRINTING OFFICER.

DATE OF REQUEST | DATE MATERIAL WANTED | CLASSIFICATION | DATE DELIVERED | ORDER NUMBER

COPY ☐ NEW COPY ☐ PREVIOUS RUN

WILL JOB BE RE-RUN ☐ YES ☐ NO

QUANTITY AND UNIT (SHEETS, SETS, ETC.)

PUBLICATION OR FORM NO., TITLE OR DESCRIPTION

SIZE

NUMBER OF PAGES

PRINTING ☐ ONE SIDE ☐ HEAD TO HEAD ☐ HEAD TO FOOT ☐ AS PER SAMPLE

PROOF REQUIRED ☐ YES ☐ NO

MARGINS (HEAD) (LEFT) (RIGHT)

BINDERY ☐ COLLATE ☐ FOLD ☐ AS PER SAMPLE

PUNCH (NO. OF HOLES, DIAMETER, DISTANCE BETWEEN)

PAD SETS SHEETS

ORDER WILL LAST MONTHS

FASTENERS ☐ BRASS ☐ WIRE STITCH

IF WIRE STITCH ☐ LEFT CORNER ☐ SIDE ☐ SADDLE ☐ TOP

DISPOSITION ☐ FILE ☐ RETURN ☐ DESTROY

PAPER (STANDARD TYPE, WEIGHT, AND COLOR WILL BE FURNISHED UNLESS OTHERWISE SPECIFIED)

REMARKS OR SPECIAL INSTRUCTIONS

FOR INFORMATION CONSULT

PHONE

ORDERING UNIT

SIGNATURE (ORIGINATOR OF REQUEST)

APPROVED (SHIP'S PRINTING OFFICER)

113.264

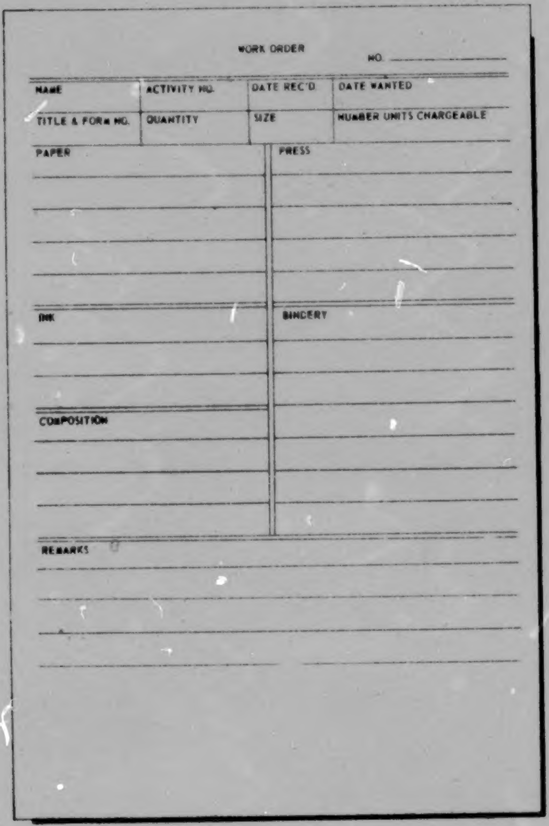
Figure 18-9.—Printing requisition.

and the other to accompany the job through the shop. Properly used, a worksheet will help assure coordination of the job and minimize errors and re-runs. After the job has been completed, file the original and three or four untrimmed copies in the work jacket along with the flats or negatives.

Always check the completion date requested for each job. Occasionally you will find that the job is already overdue by the time you receive the requisition. Make an accurate estimate as to when you can complete the job and let the printing officer or ordering activity know when the work will be ready. This will prevent bad feeling and will also allow the ordering activity to revise its plans, if necessary.

Only you or your designated assistant should be responsible for assigning priorities and completion dates. Keep your printing officer informed as to your work load, especially when schedules are tight. This will give him an idea of the status of all important jobs and will help him to decide on priorities for rush jobs presented to him.

Jobs are generally turned out in the order in which they are received, although urgent or important jobs may be given priority over the more routine work. If a classified job comes into the shop, you may want to stop other operations and put it through in one day due to the security measures involved in keeping it overnight.



WORK ORDER

NO. ____________

NAME	ACTIVITY NO.	DATE REC'D	DATE WANTED
TITLE & FORM NO.	QUANTITY	SIZE	NUMBER UNITS CHARGEABLE

PAPER	PRESS
INK	BINDERY
COMPOSITION	

REMARKS

113.265

Figure 18-10.—Work jacket.

EQUIPMENT MAINTENANCE DUTIES

In previous chapters you have been given the general maintenance procedures of major items of shop equipment. These procedures include cleaning, adjusting, and lubricating shop presses; servicing and maintaining camera-processors; and the maintenance of cold type composition machines. Aboard ship some lithographic shop equipment may be incorporated into the ship's Material and Maintenance Management (3-M) System. If your assignment is aboard ship you may have maintenance duties on a periodic basis. You may be called upon to assist or prepare the weekly schedule of preventive maintenance on such equipment. You should become familiar with the 3-M System by thoroughly reviewing the *Military Requirements for Petty Officer 3&2*, NAVPERS 10056-C, Chapter 13, and the *3-M Manual*, OPNAV 43P2.

SUPPLY DUTIES

You may be assigned the duties of the shop supply petty officer. You will be required to see that enough of the correct supplies are kept on hand, that they are properly stowed and distributed as they are required, and that repair parts are obtained as they are needed.

Policy for obtaining and storing supplies differs somewhat between the various types of ships. Generally, paper and repair parts are stored in the ship's storerooms while other supplies such as film and chemicals are forwarded to the print shop as soon as they are received by the supply department. When supplies are "Direct Turn-Over" (DTO) to the print shop, it will be your responsibility to store them properly.

It is best to group everything of one kind in the same spot, keeping the most frequently used items in the most accessible places. Open only one package at a time and mark the other packages so you can tell what is in them without tearing out their corners.

Items which have an expiration date or specified shelf life should be arranged so that the older stock will be used first, and such items should be stored in areas where they will not be damaged by sweating bulkheads, light, or heat.

You should work out a high/low stock level with your Storekeepers for the items which are kept in the supply department storerooms. This will enable them to automatically reorder an item before it is depleted.

It will also be necessary for you to keep a running inventory on the supply items kept in the shop. When an item reaches a low limit, you will have to submit a requisition through the supply office. A running inventory also enables you to know at any time how much stock is on hand.

In addition to a running inventory, you should make a physical check of the supplies in the print shop and in the storerooms at regular intervals. Look for damaged packages and materials which have been on hand beyond their expiration date as well as for excess quantities of an item.

If you are aboard ship, take an inventory and prepare requisitions prior to the ship's entering port for an extended period. When this is done, the supply department will be in a better position to furnish the required items while the ship is in port. This will help to prevent a shortage of supplies when you are at sea, far from the source of supply.

While it is desirable to have an adequate amount of supplies on hand, do not go overboard and overstock. Overstocking deprives the ship of valuable space and leads to waste, since many of the shop's supplies deteriorate with age.

REQUISITIONING SUPPLIES

Most supply departments aboard ships with print shops have automatic data processing systems to speed up the flow of paperwork. In supply circles, such ships are called "automated" ships. To draw materials as well as to request the supply department to procure supplies from off the ship, you must use the DOD Single Line Item Requisition System Document (Mechanical), DD Form 1348(M). (See fig. 18-11.)

If you are the supply PO, you will be given training by your activity's supply department to enable you to properly fill out a DD 1348 and to maintain the supply records required. In brief, the DD 1348 must have such information as the Federal Supply Number (FSN) of the item, its unit of issue, the quantity requested, the cost of the item, and a document number comprised of a date code and requisitioner code.

Your department head or his representative may sign the form before you submit it to the supply department. At some activities, the department head may require it to be logged in a master log kept within the department for accounting purposes. Once the form has been logged in and signed, it is taken to the supply department for issue if the material is onboard or it is ordered through the supply system. Be sure that any material that is received is carefully inspected before accepting it. If the shipment is satisfactory, it is signed for and a copy of the 1348 should be retained for the shop records.

Repair Parts

When ordering repair parts for equipment aboard ship, you should consult your ship's Consolidated Shipboard Allowance List (COSAL). Your department head or division office should have a copy of the COSAL section which lists all equipment in the department. This listing includes under each item of equipage, the spare or repair parts considered necessary to support or maintain that equipment. You use the nomenclature, stock number, and other information listed when you fill out the form requesting an item.

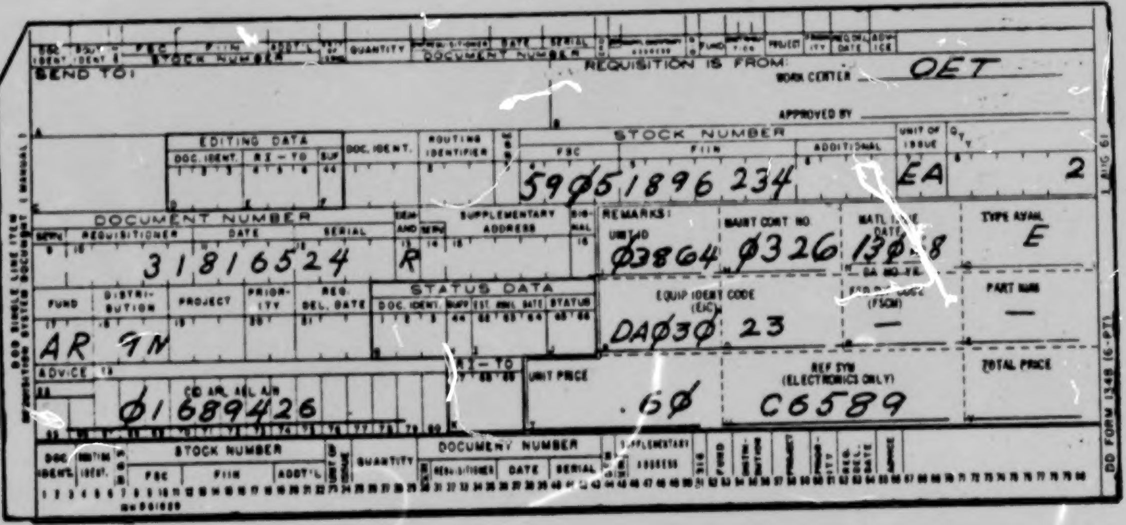
If the required part is not listed in COSAL, you should consult the manufacturer's catalog or the operator's manual for the equipment to find the manufacturer's number and description of the repair part. You should then furnish complete and detailed information on a Form Requisition Non FSN DD 1348/6 to assist the supply department in procuring the part. You should attach an approved DD Form 1348 to the DD 1348/6 before submitting it to the supply office.

A listing of manufacturer's technical and operating manuals can be found in *Navy Stock List of Forms and Publications*, NAVSUP P2002. A partial list of these manuals is given in Appendix I of this manual. Most of these manuals include a parts list section. You may also obtain books and manuals by contacting the local manufacturer's office in your area or by writing to the manufacturer. In most instances, the manuals are provided free of charge.

In instances when it is necessary to procure supplies or parts from commercial sources, the supply department will use the information you supplied to prepare a formal requisition. The supply office should furnish you with the requisition number of the formal requisition so that you may reference it if it is necessary to inquire about the status of an item.

Imprest Fund

The supply department maintains an imprest fund which is similar to a petty cash fund. It



SEND TO:

REQUISITION IS FROM:

WORK CENTER OET

APPROVED BY

EDITING DATA

STOCK NUMBER: FSC 5905 FIIN 1896 234

UNIT OF ISSUE: EA

QTY: 2

DOCUMENT NUMBER: 3181 6524

R

REMARKS:

UNIT ID 03864

MAINT CONT NO 0326

MATL ... DATE 130?8

TYPE AVAIL E

STATUS DATA

FUND: AR

DISTRIBUTION: 9N

EQUIP IDENT CODE (EIC) DA030 23

(FSCM) —

PART NO —

ADVICE

CD AR, AEL AIR 01689426

UNIT PRICE .60

REF SYM (ELECTRONICS ONLY) C6589

TOTAL PRICE

DD FORM 1348 (6-PT)

43.24

Figure 18-11.—DD Form 1348 is used to requisition supplies. Complete instructions for the use of the form are available through the supply department at your activity.

may be used to make certain purchases from commercial sources on a "cash and carry" basis. A $100 limit ($250 under emergency conditions) is placed on imprest fund purchases.

The imprest fund is in the custody of the "imprest fund cashier". When a purchase is required, he advances imprest funds to the man who is going to make the purchase. The man will sign a receipt for the money which is retained by the fund cashier. The man making the purchase will be given a special form which must be filled in by both the man and the supplier at the time of purchase.

Before submitting a request for imprest funds, you should contact the supplier to determine if the materials are available and their approximate selling price. Then prepare a DD Form 1348 and submit it a day or two in advance of the planned purchase date. The supplies should be obtained and the receipts returned to the cashier in one day.

SHOP LAYOUT

The chances are that your shop layout was arranged long before you took over. However, to make sure that all operations are functioning properly, you should analyze them occasionally to see if each step gives you the most efficient use of space and equipment. If you believe that you can plan a better layout, you should try to effect the necessary changes by working through the proper authorities in the chain of command.

To be completely effective, the equipment must be placed so that it is accessible. Properly arranged, it saves waste motion and reduces walking distance. This enables your men to turn out more work in a shorter length of time.

Work operations should be planned to follow one another in a logical sequence through the plant. Each step should bring the job progressively closer to the bindery.

On shipboard, of course, space limitations and consideration of the motions of the vessel, i.e., pitch and roll, frequently dictate layouts in which convenience and sequence of operations have to be subordinated.

Routing Work Through the Plant

In shore stations there may be an office and a separate room for each department. (See fig.

18-12.) In such a case, the job is generally planned in the office and then sent to the copy preparation department where it is typed or ruled up, art-work is done, and the copy is pasted up for the cameras. The copy preparation room is generally close to the office. This is because copy preparation is logically the second step in routing work through the plant and also because questions often arise during the preparation of the copy. Since it is easier for the copy preparer to consult the office regarding these matters if the two departments are close together, the copy preparation is often done right in the office.

The process cameras should also be placed fairly close to the office, because the copy normally flows from the copy preparation department to the camera room. Here again, the cameraman may have occasion to consult the office or copy preparation department regarding various aspects of the job.

The stripping and platemaking departments should be placed somewhere between the cameras and the pressroom and bindery. The pressroom and bindery are generally located near a wide entrance to bring skids of paper in and out.

If the plant has hand type and letterpress equipment, they should be grouped together. The hand composition room and the platen press are sometimes partitioned off in a separate section.

JUDGING THE QUALITY OF THE WORK

You check the work turned out by each unit in the shop. You must also approve the first proofs when a job is put on the press. Before OK'ing a print, you should check it against the instructions on the job jacket. See that the image is sraight and positioned properly on the sheet and that there are no printing defects. If the sheet is being backed up, or if close registration is required, you should check it over a light table.

Check important jobs or long runs several times during the run to make sure that the plate is still printing properly and that the color and position have not changed. Other types of work, such as routine forms, will not require a great deal of attention, but even simple jobs for interoffice use should be straight and readable.

Many supervisors work all jobs up to the sheet size of the smallest press. Then they can run a job on the small press or they can run it on one of the larger presses, singly or in units. Work is generally assigned to the presses according to the size of the job and the workload of the presses, although inking and other considerations sometimes enter the picture.

The good supervisor is always cost-conscious as well as production minded. He estimates the quickest, best and most economical method for turning out the work.

Suppose, for example, that you are asked to run 4000 copies of a single page instruction.

You might have two negatives shot and run this job two on a 14″ X 20″ press or you might use only one negative and run the job one up on a smaller press, using 8″ X 10-1/2″ precut standard stock.

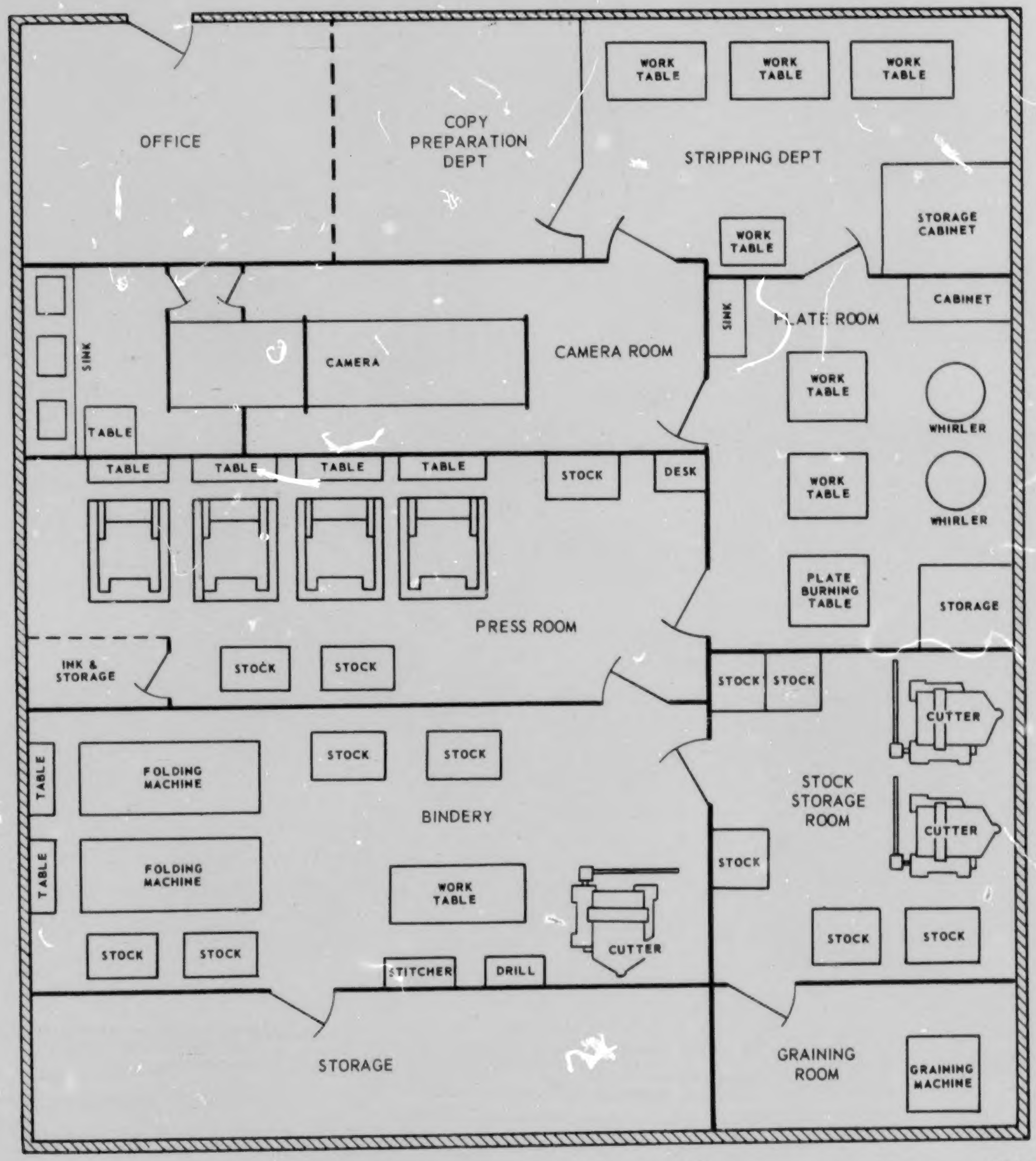
Running the job two-up naturally reduces press time; however, there are other factors which you must consider. If you use the small offset press, you will need only one negative and a small plate as compared to two negatives (or one negative and a double burn) on a larger, more costly plate. The type of paper used in running the job two up may also be more expensive than the standard precut 8″ X 10-1/2″ stock. In addition, there is the time involved in making the extra negative or printing the same negative twice on the plate.

The old saying "Time is money" holds true in the Navy as well as in civilian print shops, but you must weigh one factor against another and try to get the work done in the most economical as well as the quickest way. Think economy and your men will think the same.

JOB ESTIMATING

There will be times when you will be called upon to estimate in advance the time that will be required to complete a job. If the job is small, the task will be fairly simple, but if it is large, the estimate can be difficult, because so many factors must be considered.

Many Navy shops have letterpress and offset equipment combined in the same shop. The first


OFFICE
COPY PREPARATION DEPT
WORK TABLE
WORK TABLE
WORK TABLE
STRIPPING DEPT
STORAGE CABINET
WORK TABLE
SINK
CAMERA
CAMERA ROOM
TABLE
SINK
PLATE ROOM
CABINET
WORK TABLE
WHIRLER
WORK TABLE
WHIRLER
PLATE BURNING TABLE
STORAGE
TABLE
TABLE
TABLE
TABLE
STOCK
DESK
PRESS ROOM
INK & STORAGE
STOCK
STOCK
STOCK
STOCK
CUTTER
CUTTER
STOCK STORAGE ROOM
STOCK
STOCK
STOCK
TABLE
FOLDING MACHINE
STOCK
STOCK
BINDERY
TABLE
FOLDING MACHINE
WORK TABLE
CUTTER
STOCK
STOCK
STITCHER
DRILL
STORAGE
GRAINING ROOM
GRAINING MACHINE

113.267

Figure 18-12.—Typical layout for a lithographic shop at a shore establishment.

thing to be considered is which process is to be used.

Estimating for Offset

When the job is to be run offset, you must consider such things as the condition of the copy; the time required for composition, artwork, drafting, or corrections; the availability of chemicals and supplies; the time required for preparing the chemicals; and the makeready time for the presses; as well as the actual operating time for each section. The skill and efficiency of the operators and the possibility of breakdowns or delays must also be taken into consideration.

Although it is impracticable to use a list of set times for various operations, the following figures have been included to guide you in making time estimates. You can use them as a guide, but you will find it necessary to modify them according to the job and the operating conditions in your plant.

Operation	Time
Estimating, scheduling, writing up job ticket, artwork, and corrections	60 min.
(This estimate depends, of course, on the condition of the copy. Some jobs may require no artwork or corrections; others may require from 15 minutes for simple additions; such as reference marks or numbers, to several days for extensive corrections.)	
Negative making:	
Initial preparation of chemicals and equipment	60 min.
Line negatives:	
First negative, using scale focusing	15 min.
First negative, using ground glass focusing	30 min.
Each additional negative (at same camera setting)	5 min.
Halftone negatives:	
First negative, including setting screen and camera	30 min.
(This estimate depends on the skill of the operator.)	
Each additional negative, at same camera setting	15 min.
(When using filters with either line or halftone negatives, the time depends on the filter factor. For line negatives, add 50 percent to the estimated negative making time; add 100 percent for halftones.)	
Negative opaquing and retouching (minimum)	15 min.
Stripping, one negative to a flat	15 min.
(Add 5 minutes for each additional negative or position.)	
Platemaking:	
Presensitized plates:	
Exposing	10 min.
Each additional exposure	6 min.
Developing	5 min.
Photo-direct plates:	
Exposing and developing	5 min.
Wipe-on plates:	
Coating	15 min.
Exposing	10 min.
Developing	5 min.
Presswork:	
Initial preparation and makeready time	60 min.
Running time, single color line work (4,000 impressions)	60 min.
Running time, register work (2,500 impressions)	60 min.
Makeready time for each additional plate with same color of ink:	
10″ × 14″ and 14″ × 20″ presses	5 min.
17″ × 22″ or larger	20 min.
Cleanup of press for change of color of ink or at the end of the day's run	30 min.

Operation	Time
Bindery operations:	
Cutting (1,000 sheets)	
1 or 2 cuts	10 min.
3 or 4 cuts	15 min.
Padding (1,000-5,000 sheets)	30 min.
(If drying time is a factor, add at least 90 minutes.)	
Stitching, stapling, and drilling (depending on the skill of the operator and on the job), 700 books	60 min.
Folding:	
Original setup	60 min.
28" X 44" stock (3,000 sheets).	60 min.
19" X 25" stock (6,000 sheets)	60 min.
9" X 12" stock (10,000 sheets)	60 min.
Gathering (1 person):	
1,500 inserts	60 min.
2,000 singles	60 min.

To allow for unforeseen delays, some operators add about 25 percent to the total estimated time. However, you must also remember that under favorable conditions, similar work, continuous production, and overlapping operations will often cut your estimated production time in half.

It is possible, for example, to run up to 100 plates (75 impressions each) per day on the small presses (duplicators), and you can plan on turning out roughly 18,000 to 20,000 impressions a day on the larger presses, provided the run for each plate is at least 2,000 copies.

To illustrate this point further, suppose that 500 copies of a single-color, same-size line drawing are required. Using the operation times just discussed as a basis, you might come up with the following estimate.

Operation	Time
Administration and routing	15 min.
Negative making (assuming chemicals were prepared during administration time)	15 min.
Opaquing and retouching	15 min.
Stripping	15 min.
Platemaking (presensitized plate)	15 min.
Press makeready	15 min.
500-sheet run	10 min.
Total production time	100 min.
25 percent allowance for contingencies	25 min.
Total time estimate	125 min.

COLDTYPE COMPOSITION

Estimates for coldtype composition depend on the kind of machine used, the speed of the operator and the nature of the copy—whether it is justified or unjustified and whether it consists of straight composition or forms. It is estimated that a skilled typist who is acquainted with the machine can type 40 to 45 words per minute when producing unjustified copy on a Vari-Typer, Justowriter, or an IBM Proportional Spacing Machine. You can adjust the following estimates as necessary to your particular shop:

Operation	Time
Setting up the machine	5 to 10 min.
Typing unjustified copy (6,000-8,000 characters)	60 min.

ESTIMATING FOR LETTERPRESS WORK

The time required for estimating, scheduling, and writing up the job jacket for letterpress work will depend on your own experience and thoroughness. As a rule, it should not take longer than 30 minutes to perform all these operations, and you will usually be able to complete them in a much shorter time.

Handset Composition

You may find the following table handy in estimating time for handset composition.

Lines to the inch	Time required to set (in minutes) times the number of square inches in form
1.	1
2.	1 1/2
3.	2
4.	2 1/2
5.	3
6.	3 1/2
7.	4
8.	4 1/2
9.	5
10.	5 1/2
11.	6
12.	6 1/2

You should double the time listed in this table if the job consists of a variety of typefaces, rule or leaderwork, or if it has any other unusual features. You should also add from 3 to 5 minutes for preliminary operations, such as setting the stick for the proper length of line, procuring necessary spacing materials, and so on.

Here's how the table works. Suppose that you are setting a card with form dimensions of 2″ X 3″ or 6 square inches, and there are 6 lines of type (3 lines to the inch). By consulting the table, you will see that for 3 lines to the inch, you should multiply 2 minutes by the number of square inches in the form. Two minutes times 6 equals 12 minutes. Add 3 minutes for preliminary operations, and you will have 15 minutes, which is about the length of time required for a competent compositor to set such a job.

Now take another example. Suppose you are setting an announcement with 12 lines of type which are to go into a space 3 inches wide and 3 inches deep (9 square inches). First divide the 12 lines by the depth of the form (3 inches). This will give you 4 lines to the inch. By consulting the table, you will see that for 4 lines to the inch, you should multiply 2 1/2 minutes times the number of square inches–9 in this case. Multiplying 9 by 2 1/2 gives you 22 1/2 minutes, to which you should add 3 minutes for preliminaries. This will give you a total of approximately 26 minutes, as the time required to set such a form. A fast compositor might do it in 20 minutes, and a slow operator might require 30 or 35, but this will give you a pretty good average time.

Makeup

It is difficult to generalize on makeup time, since so much depends on the size and nature of the form. However, you may try the following formulas, and if you find that they do not work satisfactorily for your particular setup, you can revise them or dispense with them and draw on your own experience.

For making up simple forms, you may allow 10 to 25 per cent of the original composing time. For rule forms or display work, allow 15 to 35 percent if the job was set on the Linotype machine, or 25 to 40 percent if it was set by hand. If the form is extremely complicated, allow 50 to 75 percent of the composing time for makeup purposes.

Proofing and Proofreading

You can proofread and correct the average small job in 5 to 10 minutes. A large handset form may take from 15 to 30 minutes. This, of course, depends on the number of errors and the skill of the man doing the work.

Imposition and Lockup

A good operator can generally lock a simple 6″ X 9″ form in 5 to 10 minutes. Larger forms up to 12″ X 18″ may require 15 to 20 minutes. This time may be increased to 30 minutes if the form consists of 8 or more pages, or if the makeup is complicated or if close register is involved. These figures depend on the job and shop conditions, of course. You must use judgment in their application.

Makeready

As a rule, forms composed of Linotype slugs and line cuts will require little makeready; forms carrying handset type, numbering machines, perforating rules, and so on, will require more. All forms containing halftones require careful makeready.

Although other factors may enter into the picture, you may be able to estimate makeready time as follows:

For platen presses

Size of form	Ordinary work	Quality work
3" X 5"	6 min.	15 min.
5" X 7"	10 min.	20 min.
8" X 12"	15 min.	25 min.
10" X 15"	20 min.	40 min.
12" X 18"	30 min.	60 min.

To this, you should add 25 to 40 percent extra time for forms containing halftones or requiring close register. You should also add 10 minutes for setting up the open press and 25 minutes for setting up the automatic feeder press.

Press Time

Press time will depend on the speed of the press, the kind of job being run, and the condition of the stock. You can adjust the following figures to suit your own equipment.

	Average impressions per hour
Hand-fed presses	1,000
Automatic platen presses	2,000

Distribution and Cleanup Operations

Many printers include cleanup operations under other headings. For the average job, you may allow 5 to 10 minutes for cleaning the type, unlocking it, and transferring it to the galley rack or bank for distribution.

TRAINING NEW MEN

You should train personnel in your division to be careful when they are working around moving machinery or with toxic chemicals. Practice safety first—and last. That's good advice and you should emphasize it to your men. Always explain safety precautions so the men will see the need for them. Don't under any circumstances let a safety violation go unnoticed or unchallenged.

It is also a good idea to establish some kind of system for automatically replacing ill or injured men as well as for continuing operations despite equipment breakdowns and shortages of supplies.

Work Rotation

You can solve the replacement problem by rotating the work so that each man will have a chance to learn new skills. Rotation of work is a time-honored tradition of the printing trade. The word "journeyman" sprang from the rotation system. The early printshops were limited in equipment and it was necessary for an apprentice to work in shops in several different cities to obtain a well-rounded printing background. After he had worked in three or more shops, he was considered a skilled printer. And he was called a "journeyman" because he had traveled from one town to another in acquiring his experience.

Rotation of work still plays an important role in providing a man with a well-rounded background. So rotate assignments. Don't keep one man on the press all the time. Shift him to the camera or the platemaking department when possible. Let all the men have a crack at each operation. This will give your men more knowledge and experience and enable them to advance more rapidly. And you will also benefit. If your best cameraman is transferred, you won't have to break in a new man; you'll already have an experienced replacement.

On-the-Job Training

As a rule, young men are eager to learn and they should be given every opportunity to learn all they can. Get your men together for instruction as often as possible. Even your best men can learn more about their jobs. Tie their work and training together. Use the skilled men to train the others in your outfit. Pair the untrained men off with some of your more experienced operators. Keep every man learning and you will have a wide-awake outfit ready to meet any emergency.

There may be times when the men in your shop will be required to work 12 to 16 hours a day to complete rush jobs. At other times, you will have nothing but routine work for several days at a stretch. That's the best time to train men or to make changes in working procedures, because it gives the men plenty of time to grasp new ideas. During slack periods, when the equipment in the shop is not required for the regular work, assign practice jobs to your strikers and lower-rated men.

When training someone, explain the processes step-by-step. Don't go to a following step until the trainee demonstrates his understanding of the preceding step. Don't skip over any steps or take any shortcuts. Instruct in safe and sure methods only.

It is important that a new man be trained properly from the start because it will be difficult for him to change his working habits once he has them fixed in his mind. Always teach him the safety rules before you allow him to operate any piece of equipment so that he will fit them into his working technique. Be sure that he has learned the fundamentals of the job before you turn him loose on his own. It is a good idea to divide your instruction between practice and theory. Tell him why; show him how; then give him a chance to try it himself.

When you let a man tackle a new job, keep an eye on him, but don't butt in and take over when he makes his first mistake. Stop him and explain the error. Then let him correct the mistake himself. Right from the start, teach him good working habits, such as cleaning and oiling his equipment and putting his tools away after work.

Pay particular attention to the training of men who are weak in one or two phases of the work. If a man lacks skill in a certain operation, allow him to work at it under the guidance of a skilled operator.

The More They Learn, the More They Earn

Show your men how they can benefit from learning. Point out that men who have learned skills are generally well respected. At the same time develop in your men a spirit of working together as a unit. Togetherness will benefit them and you.

Be consistent and reasonable. Give your men a sense of security–a feeling that they will know just what to expect of you. Describe precisely what you want them to do so there will be no misunderstanding. Praise good work and correct bad work without causing hard feelings.

It is important, too, that a new man be given some idea of what he is expected to know when he has completed his training period. This will make him aware of specific goals and give direction to his efforts.

You should set standards at an appropriate level and acquaint the man with them; then train him to achieve them. Occasionally, you will come across a dawdler. Assign such a man a reasonable but specific amount of work each day and see that he accomplishes it.

The responsibilities of each person in the shop should be clearly defined. Several people may use the camera, small offset press, C & P, and so on, during the course of a day, but only one person should be responsible for the maintenance of a particular piece of equipment. You should also assign one man to maintain each of the physical areas of the shop. Little things mean a lot to efficient operation. Loose paper lying around the pressroom is not only unsightly, it is also a fire hazard and can be dangerous to the press operator. Similarly in the darkroom, keeping bottles tightly covered prevents spillage, evaporation, keeps out dust, and so on.

Safety Training

You cannot overemphasize the necessity for proper safety precautions to your men. Men who are new at operating printing equipment sometimes find it hard to realize the danger in all those moving parts, and it is not possible to show by demonstration what can happen if a finger gets in the wrong place and the gears cut it off. Then, too, men who have been operating the same piece of equipment for a long period of time often become over confident and become careless in the use of the equipment.

Basic safety practices for the print shop are discussed throughout this manual. Emphasize their importance whenever you are training new men.

Make It Interesting

Printing is not only a fine profession, it is an interesting hobby. This is evidenced by the fact that the country is dotted with hundreds of basement printshops which men operate as an avocation. And this brings up an important point. Good printers enjoy their work. To them, it is more than a job. This enthusiasm for the work will build in the man who continues to learn and develop and increase his selfworth. Operate the shop by leading the men in this direction. The more junior personnel may need more encouragement to keep them on the right track. It's often a good idea to let a person find some things out for himself. One way to go about this is to have a man discover something on his own by leaving a pertinent instruction or magazine article where he will find it and be able to use it in his job.

Set a good example by keeping up with all the latest information, not only about the equipment in the shop, but also with new developments in the graphics industry. Keep abreast of the trade show schedules coming to your area and attend them whenever possible.

Appendix I provides a list of books covering the operation and maintenance of lithographic and letterpress equipment. These books may be ordered from the Naval Supply Depot, Philadelphia, Pa. Besides these manuals, appendix I also lists a number of good commercial books on printing, as well as leading trade magazines and newspapers. You can generally find some of these publications at any public library or printers' supply house.

Reference Library

You should establish a small library in your shop or quarters if you can. You may begin such a library with one or two good books on printing and a few manufacturers' instruction manuals. You can also add books on such related subjects as paper, ink, type, and so on.

Allowance lists and supply catalogs are also very useful, and so are catalogs and advertising literature from commercial firms. They will provide you with valuable instructional material. You can obtain advertising literature by writing to the manufacturers of the equipment or by dropping in to see their local representatives.

You can obtain technical publications of the Navy through your education officer or division officer.

Lend your books to the men who work with you and encourage them to lend their books to each other. The more a man knows about his job the more useful he is to himself and to the Navy.

APPENDIX I

ADDITIONAL REFERENCE READING

Here are some books that every Lithographer will want to read:

TRADE BOOKS

The Printing Industry, Victor Strauss, 1967, Printing Industries of America, Inc., 20 Chevy Chase Circle, N. W., Washington, D. C. 20015.

Printing and Production Handbook, 3rd edition, 1966, Daniel Melcher and Nancy Larrick, McGraw-Hill Book Co., Inc. New York, N. Y. 10036.

General Printing, rev. ed., 1967, Cleeton, Pitkin and Cornwell, McKnight and McKnight Publishing Co., Bloomington, Ill. 61701.

The Practice of Printing, Ralph W. Polk, 1964, Manual Arts Press, Peoria, Ill. 61614.

Lithographer's Manual, Graphic Arts Technical Foundation, Pittsburgh, Pa.

ITU Lessons in Printing, International Typographical Union, Indianapolis, Ind.

Photo-offset Fundamentals, John E. Cogoli, 1967, McKnight and McKnight Publishing Co., Bloomington, Ill. 61701.

GPO Style Manual, U. S. Government Printing Office, Washington, D.C. 20402.

The Offset Process (complete series of publications) Technical Trade School, the International Printing and Pressmen and Assistants' Union, Pressmens' Home, Tenn. 37850.

Graphic Arts Technical Foundation (complete series of publications relating to offset printing) Pittsburgh, Pa.

GPO Training Series (6 volumes, 1964), U. S. Government Printing Office, Washington, D. C. 20402.

Kodak Wratten Light Filters, Eastman Kodak Co., Rochester, N. Y. 10017.

Photo Lab Index, Henry M. Lester, Morgan and Morgan, New York, N. Y. 10017

Graphic Arts Procedures, the Offset Processes, R. Randolph Karch and Edward J. Buber, American Technical Society, 848 E. 58th St., Chicago, Ill. 60637.

TRADE MAGAZINES

The Inland Printer/ American Lithographer, 79 West Monroe St., Chicago, Ill. 60603

Printing Magazine, 475 Kinderkamack Rd., Oradell, N.J. 07649
Lithographer's Journal, 143 W. 51st Street, New York, N.Y. 10004
Modern Lithography, Box 31, Caldwell, N.J. 07006
Reproductions Review, 134 N. 13th St., Philadelphia, Pa. 19107

PRINTING AND LITHOGRAPHIC EQUIPMENT AND INSTRUCTION BOOKS

The following operator's manuals and parts catalogs are available from the Navy Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pa. 19120. This list changes from time to time. For latest list of publications available, consult the Navy Stock List of Forms and Publications, Cognizance Symbol I, NavSup Publication 2002.

CAMERAS

Stock Number	Title	Manufacturer
0391-123-9000	Camera, Lithographic Copying, Darkroom type, 24" x 24", Model WP-300, Panel-control 115v, AC Arc Lamps, 220V AC, 3 PH, Vacuum Pump 110V AC.	Bellingham Chain and Forge Company, Inc.
0391-117-7000	Camera, copying, lithographic darkroom type, 24" x 30"	Bellingham Chain and Forge Company, Inc.
0391-119-1000	Camera, copying, darkroom type, 24" x 30" Model WP-400	Bellingham Chain and Forge Company, Inc.
0391-120-8002	Camera, copying, lithographic darkroom type, 24" x 30", Capacity 60 cycle vacuum pump 440V AC, 3PH, 115V AC Control panel	Bellingham Chain and Forge Company, Inc.
0391-107-5000	Camera, darkroom type, 16" x 20"	Consolidated International Equipment and Manufacturing Co.
0385-003-2000	Camera, Special Monotype Directoplate	Lanston Monotype Machine Co.
0385-016-2000	Camera, Vertical Process	The Douthitt Corp.
0391-110-2000	Camera, 16" x 20"	Consolidated International Equipment and Manufacturing Co.

0391-111-2000	Camera, 24" x 20"	Consolidated International Equipment and Manufacturing Co.
0391-108-7000	Camera, 24" x 24", Model 241	American Type Founders Sales Corp.
0991-014-7000	Camera, Vertical For Reproducing Copy, Meteorite Model	Robertson Photo-Mechanix Co.

ARC LAMPS

0391-109-4000	Lamp, Camera, Arc, 220V	Macbeth Arc Lamp Co.
0391-109-5000	Lamp, Printing Arc, 220V	Macbeth Arc Lamp Co.
0391-109-6000	Lamp, Arc, 115V, BuShips, No. S18-L-152-300	Macbeth Arc Lamp Co.

VACUUM PUMPS

0391-107-3000	Pump, Vacuum, Photographic Use, Model G	Yeomans Bros, Inc.
0991-019-2000	Pump, Vacuum, Photographic Use, Model G	Yeomans Bros, Inc.
0347-407-6000	Pump, Vacuum, Photographic Use, 1/2 HP, 115/230V, 1PH, 60 Cycle, 1725 RPM, Model G	Yeomans Bros, Inc.

SINKS

0391-107-6000	Sink, Developing, Photolithographic	Chemco Photo Products, Inc.
0391-115-5000	Sink, Photoprocessing, Temperature Controlled with refrigerated storage cabinet	Heifetz Metal Crafts Co.
0391-115-6000	Sink, Photolithographic Processing Temperature Controlled	Warren Corp.

0391-118-6000	Sink, Photolithographic Processing Temperature Controlled for AC and DC power	Warren Corp.
0391-121-6000	Sink, Photographic Processing Temperature Controlled with Refrigerated Storage Cabinet	Bar Ray Products, Inc.
0391-120-1000	Sink, Temperature Controlled for Photolith Processing with Water Circulating System, DC power	Warren Corp.
0385-025-6000	Sink, Photographic Processing PS-100	Bauer Mfg. Co.
0391-116-5000	Sink, Temperature Controlled with Refrigerated Storage Cabinet	Bar Ray Products, Inc.

PLATE-PROCESSING EQUIPMENT

0391-114-2000	Processing Machine, Plate, Photolithographic	Rutherford Machinery Co.
0391-120-6000	Printer, rapid, automatic arc control, Model RP 21A	NuArc Co.
0391-119-9000	Frame, Printing Vacuum-type Cabinet	Consolidated International Equipment and Manufacturing Co.
0391-120-2000	Frame, Printing Vacuum	Jos. Gelb Co.

STITCHERS

0391-120-0002	Stitcher, Book 1/3 HP, 115/230V DC, 1800 RPM, across line control, Size O, No. 3P-1200, No. 7	Bostich, Inc.
0391-116-0000	Stitcher, Book, Boston No. 7	Bostich, Inc.
0391-110-4000	Stitcher, Wire, Model N3A3-4	Acme Steel Co.
0391-108-9000	Stitcher, Wire, Model N8	Gitzendanner-Muller Co., Inc.

PLATEN PRESSES—LETTERPRESS

0991-025-7000	Press, Printing, Platen 8" x 12"	Chandler & Price Co.
0391-121-5000	Press, Printing, Platen, Model N, Power Driven	Chandler & Price Co.

PROOFPRESS—LETTERPRESS

0391-110-7000	Press, Proof, Model 1	Vandercook & Sons, Inc.

BLUE LINE PRINTING MACHINES

0391-118-8000	Printing Machine, Automatic White, Revolute Comet	Paragon Plastic Corp.

PAPER PUNCHING MACHINES

0322-000-2000	Punching Machine, Multiple, Portland, Foot Powered	American Type Founders Sales Corp.

OFFSET PRINTING PRESSES

0991-076-4010	Press, Printing, Offset, 23" x 36", volume 1	Harris-Seybold Co.
0991-076-4020	Press, Printing, Offset, 23" x 36", volume 2	Harris-Seybold Co.
0391-115-9000	Press, Printing, Offset, 23" x 36", volume 1	Harris-Seybold Co.
0391-115-9200	Press, Printing, Offset 23" x 36", volume 2	Harris-Seybold Co.
0391-109-0000	Press, Printing Offset 22	American Type Founders Sales Corp.
0391-121-2000	Press, Printing, Offset Multilith, Class 1250	Addressograph-Multigraph Corp.
0391-109-3000	Duplicator, Multigraph-Multilith Process	Addressograph-Multigraph Corp.
0391-117-2000	Press, Printing, Offset 14" x 20", Chief 20	American Type Founders Sales Corp.

0391-147-3000	Press, Printing, 14" x 20" Chief 20A	American Type Founders Sales Corp.
0391-110-8000	Press, Printing, 14" x 20" Chief 20	American Type Founders Sales Corp.
0391-120-4000	Press, Printing, Offset, 14" x 20" Model ATF Chief 20	American Type Founders Sales Corp.
0391-125-6000	Press, Printing, Offset, 17 1/2" x 22 1/2" 440V, 3PH, 60 Cycle, Chief 22	American Type Founders Sales Corp.

FOLDING MACHINES

0391-145-5000	Folding Machine, Automatic, 4" x 4" minimum; 17" x 28" maximum sheet size; 115V, 1PH, 60 Cycles, Model FH-6	The Challenge Machinery Co.

PAPER DRILLING MACHINES

0391-120-7001	Drill, Paper, Print Shop, Model E	The Challenge Machinery Co.
0391-111-5000	Drilling Machine, Paper	Super Speed Printing Machinery Co.
0391-116-4000	Drilling Machine, Paper, Single Spindle, N-D Stationary Table Model K4N	Nygren-Dahly Co.

PAPER CUTTERS

0391-122-1000	Cutter, Paper, Guillotine, Hand Lever Operated, Hand Clamp, Size 19 3/8"; Series H; Model 193H	The Challenge Machinery Co.
0391-120-9000	Cutter, Paper, Guillotine 26 1/2", Hydraulic Series, Model 1265-HB Motor-Elec. 1 1/2 HP, 440V, 3PH, 60 Cycle AC. Model 5KR184AG363 Controller Magnetic 10 HP Max., 440V, 3PH, 60 Cycle. Model IC5130-B46H; Pushbutton Model IC-5844C-201A150	The Challenge Machinery Co.

0391-119-0000	Cutter, Paper, Guillotine 36 1/4", Motor Driven, Hand Clamp 230V DC	The Challenge Machinery Co.
0391-120-3000	Cutter, Paper, Guillotine 36 1/4", Motor Driven, Hand Clamp	The Challenge Machinery Co.
0391-117-1000	Cutter, Paper, Guillotine, 37" Motor Direct Hand Clamp	Chandler & Price Co.
0391-122-8000	Cutter, Paper, Guillotine 26 1/2", Power Clamp, Motor Drive	Chandler & Price Co.

LINEUP AND REGISTER TABLES

0391-108-8000	Table, Layout, Photolith, Model RO-P	Craftsman Line-Up Table Corp.

COMPOSING AND TYPESETTING MACHINES

0391-120-5000	Varityper Machine, Model 160	Varityper Corp.
0391-152-2000	Varityper, Standard Model F-16	Varityper Corp.
0391-137-1000	Varityper Machine, Operators Manual Standard Models	Varityper Corp.
0391-023-0000	Varityper Headliner Model 800	Varityper Corp.
0332-001-6000	Linotype Machine	Mergenthaler Linotype Co.
0391-145-3000	Linotype Machine Installed	Mergenthaler Linotype Co.

APPENDIX II

FORMULARY

Gum Arabic solution

acacia crystals	2 lbs
water	58 oz

Note: Stir often until crystals dissolve. Filter through cheesecloth. Bring to 14° Baume.

Press fountain stock solution (aluminum)

magnesium nitrate	
or	9 av oz
zinc nitrate	
ammonium dichromate	1 3/4 oz av
phosphoric acid, 85%	5/8 oz
water to make	1 gallon

Note: For use in fountain, add 2 liquid ounces of stock solution and 3/4 ounce gum arabic solution to 1 gallon of water.

Cleaner, glass

alcohol, grain, 190	1 part
ammonia solution, 5%	1 part

Fixer, film and paper

ammonium thiosulfate	25 oz
sodium sulfite	2 1/2 oz
acetic acid, 28%	6 oz
boric acid	1 oz
potassium alum	3 oz
water to make	1 gallon

Note: Discard when clearing time exceeds 6 minutes. Use full strength for films, dilute with equal amount of water for paper. Do not allow prints to remain in bath more than 8 minutes.

Fixer, film and paper

water (100° - 125° F)	20 oz
sodium thiosulfate (hypo)	8 oz
sodium sulfite	1/2 oz
acetic acid, 28%	1 1/2 oz
boric acid	1/4 oz
potassium alum	1/2 oz
water	1/2 gallon

Fixer, film, minimum shrinkage

water	64 oz
sodium thiosulfate (hypo)	32 oz
potassium metabisulfite	4 oz
water to make	1 gallon

Developer, continuous tone, paper and film (D-72)

water (100° - 125° F)	16 oz
Elon (Metol)	45 gr
sodium sulfite	1 1/2 oz
hydroquinone	175 gr
sodium carbonate	2 1/4 oz
potassium bromide	27 gr
water to make	32 oz

Note: This developer is of the same type as Kodak Dektol and may be used as such: Use: 1 part solution to 1 part water.

Developer, contrast, line-halftone film (D-85)

water (90° F)	64 oz
sodium sulfite	4 oz
paraformaldehyde	1 oz
potassium metabisulfite	150 gr
boric acid (crystals)	3 oz
potassium metabisulfite	90 gr
water to make	1 gallon

Note: Age 2 hours before using. Develop 2 minutes.

Developer, high contrast, line-halftone film (D-8)

water (90° - 110° F)	96 oz
sodium sulfite	12 oz
hydroquinone	6 oz
sodium hydroxide	5 oz
potassium bromide	4 oz
water to make	1 gallon

Note: Use 2 parts developer to 1 part water. Develop 2 minutes.

Stop bath, film

acetic acid, 28%	4 oz
water	32 oz

In American photographic practice, solids are weighed by either the Avoirdupois or the Metric system and liquids are measured correspondingly by U. S. Liquid or Metric measure. The following tables give all the equivalent values required for converting photographic formulas from one system to the other:

Avoirdupois to Metric Weight

Pounds	Ounces	Grains	Grams	Kilograms
1	16	7000	453.6	0.4536
0.0625	1	437.5	28.35	0.02835
		1	0.0648	
	0.03527	15.43	1	0.001
2.205	35.27	15430	1000	1

U. S. Liquid to Metric Measure

Gallons	Quarts	Ounces (Fluid)	Drams (Fluid)	Cubic Centimeters	Liters
1	4	128	1024	3785	3.785
0.25	1	32	256	946.3	0.9463
		1	8	29.57	0.02957
		0.125	1(60 mins.)	3.697	0.003697
		0.03381	0.2705	1	0.001
0.2642	1.057	33.81	270.5	1000	1

Conversion Factors

Grains per 32 fluid oz. multiplied by 0.06847 = grams per liter
Ounces per 32 fluid oz. multiplied by 29.96 = grams per liter
Pounds per 32 fluid oz. multiplied by 479.3 = grams per liter
Grams per liter multiplied by 14.60 = grains per 32 fluid oz.
Grams per liter multiplied by 0.03338 = ounces per 32 fluid oz.
Grams per liter multiplied by 0.002086 = pounds per 32 fluid oz.

Ounces (fluid) per 32 oz. multiplied by 31.25 = cubic centimeters per liter.
Cubic centimeters per liter multiplied by 0.032 = ounces (fluid) per 32 oz.
cm. × .3937 = inches
inches × 2.5400 = cm.

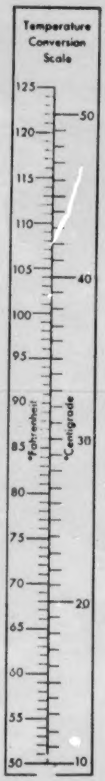


Figure II-1

or

vinegar, 50 grain strength - - - - 15 oz
water - - - - - - - - - - - - - - - - - - - 32 oz

Prehardener. For negative development at high temperatures. (Photomechanical films usually have prehardened emulsions.) Immerse negative for 2 to 3 minutes, wash for 1 to 2 minutes in water, then develop normally.

formalin (40% formaldehyde) - - 1 fl oz
sodium carbonate
(desiccated) - - - - - - - - - - - - 1/2 oz
water - - - - - - - - - - - - - - - - - - 1 gallon

Intensifier (Monckhoven). Bleach negative thoroughly in solution A; then wash 2 minutes in running water and place in blackening solution B. Wash and dry negative, following intensification.

Solution A
potassium bromide - - - - - - - - - - 3/4 oz
mercuric chloride - - - - - - - - - - 3/4 oz
water to make - - - - - - - - - - - - 1 quart
Solution B
potassium or sodium cyanide - - 3/4 oz
silver nitrate - - - - - - - - - - - - 3/4 oz
water to make - - - - - - - - - - - - 3/4 quart

In preparing solution B, dissolve silver nitrate and potassium or sodium cyanide in separate portions of water. Then add the silver solution to the cyanide solution until precipitate formed is almost completely dissolved. Allow to age for an hour or more before using.

Farmer's Reducer-single solution

Solution A
potassium ferricyanide - - - - - - 1 1/4 oz
water to make - - - - - - - - - - - - 16 oz

Solution B

sodium thiosulfate	16 oz
water to make	1/2 gallon

Note: Use 1 part A, and 4 parts B to 16 ounces water.

Farmer's Reducer - two solution

Solution A

potassium ferricyanide	1/4 oz
water to make	32 oz

Solution B

sodium thiosulfate	6 3/4 oz
water to make	32 oz

Note: Use of two solution gives overall proportional reduction.

MISCELLANEOUS TABLES AND FORMULAS

Volume

2 pints = 1 quart
4 quarts = 1 gallon
16 ounces = 1 pint
1000 cubic centimeters OR 1000 milliliters = 1 liter
1 ounce = 29.6 cc or mil
1 quart = 946 cc or mil

Optics

a. Foot candles of illumination =

$$\frac{\text{candle power of light}}{\text{distance from object to light squared}}$$

b. $$\text{Magnification} = \frac{\text{height (image)}}{\text{height (object)}}$$

c. $$\text{Focal length} = \frac{\text{distance from film to copy (with camera focused at same size)}}{4}$$

Formula for dilution

To reduce the strength of a given solution:

1. Subtract the percentage strength of the solution desired from the percentage strength of the solution to be diluted. Let this remainder be "X".
2. Subtract the percentage strength of the diluting solution (water is 0%) from the percentage strength of the solution required. Let this remainder be "Y".
3. Now, "X" parts of the strong solution mixed with "Y" parts of the diluting solution will give the correct percentage strength of the solution required.

TEMPERATURE CONVERSION TABLE

To convert either Fahrenheit or Celsius temperatures, follow the center column to the desired temperature, then read the conversion temperature in the "F" or "C" column. Thus, in the example shown, 20°F equals -6.7°C and 20°C equals 68.0°F.

°C	°	°F	°C	°	°F	°C	°	°F
- 28.9	- 20	- 4.8	- 6.1	21	69.8	16.1	61	141.8
- 28.3	- 19	- 2.2	- 5.6	22	71.6	16.7	62	143.6
- 27.8	- 18	- 0.4	- 5.0	23	73.4	17.2	63	145.4
- 27.2	- 17	1.4	- 4.4	24	75.2	17.8	64	147.2
- 26.7	- 16	3.2	- 3.9	25	77.0	18.3	65	149.0
- 26.1	- 15	5.0	- 3.3	26	78.8	18.9	66	150.8
- 25.6	- 14	6.8	- 2.8	27	80.6	19.4	67	152.6
- 25.0	- 13	8.6	- 2.2	28	82.4	20.0	68	154.4
- 24.4	- 12	10.4	- 1.7	29	84.2	20.6	69	156.2
- 23.9	- 11	12.2	- 1.1	30	86.0	21.1	70	158.0
- 23.3	- 10	14.0	- 0.6	31	87.8	21.7	71	159.8
- 22.8	- 9	15.8	0.0	32	89.6	22.2	72	161.6
- 22.2	- 8	17.6	0.6	33	91.4	22.8	73	163.4
- 21.7	- 7	19.4	1.1	34	93.2	23.3	74	165.2
- 21.1	- 6	21.2	1.7	35	95.0	23.9	75	167.0
- 20.6	- 5	23.0	2.2	36	96.8	24.4	76	168.8
- 20.0	- 4	24.8	2.8	37	98.6	25.0	77	170.6
- 19.4	- 3	26.6	3.3	38	100.4	25.6	78	172.4
- 18.9	- 2	28.4	3.9	39	102.2	26.1	79	174.2
- 18.3	- 1	30.2	4.4	40	104.0	26.7	80	176.0
- 17.8	0	32.0	5.0	41	105.8	27.2	81	177.8
- 17.2	1	33.8	5.6	42	107.6	27.8	82	179.6
- 16.7	2	35.6	6.1	43	109.4	28.3	83	181.4
- 16.1	3	37.4	6.7	44	111.2	28.9	84	183.2
- 15.6	4	39.2	7.2	45	113.0	29.4	85	185.0
- 15.0	5	41.0	7.8	46	114.8	30.0	86	186.8
- 14.4	6	42.8	8.3	47	116.6	30.6	87	188.6
- 13.9	7	44.6	8.9	48	118.4	31.1	88	190.4
- 13.3	8	46.4	9.4	49	120.2	31.7	89	192.2
- 12.8	9	48.2	10.0	50	122.0	32.2	90	194.0
- 12.2	10	50.0	10.6	51	123.8	32.8	91	195.8
- 11.7	11	51.8	11.1	52	125.6	33.3	92	197.6
- 11.1	12	53.6	11.[illegible]	53	127.4	33.9	93	199.4
- 10.6	13	55.4	12.2	54	129.2	34.4	94	201.2
- 10.0	14	57.2	12.8	55	131.0	35.0	95	203.0
- 9.4	15	59.0	13.3	56	132.8	35.6	96	204.8
- 8.9	16	60.8	13.9	57	134.6	36.1	97	206.6
- 8.3	17	62.6	14.4	58	136.4	36.7	98	208.4
- 7.8	18	64.4	15.0	59	138.2	37.2	99	210.2
- 7.2	19	66.2	15.6	60	140.0	37.8	100	212.0
- 6.7	20	68.0						

TEMPERATURE CONVERSION TABLE (cont'd)

°C	°	°F	°C	°	°F	°C	°	°F
38.3	101	213.8	60.6	141	285.8	82.8	181	357.8
38.9	102	215.6	61.1	142	287.6	83.3	182	359.6
39.4	103	217.4	61.7	143	289.4	83.9	183	361.4
40.0	104	219.2	62.2	144	291.2	84.4	184	363.2
40.6	105	221.0	62.8	145	293.0	85.0	185	365.0
41.1	106	222.8	63.3	146	294.8	85.6	186	366.8
41.7	107	224.6	63.9	147	296.6	86.1	187	368.6
42.2	108	226.4	64.4	148	298.4	86.7	188	370.4
42.8	109	228.2	65.0	149	300.2	87.2	189	372.2
43.3	110	230.0	65.6	150	302.0	87.8	190	374.0
43.9	111	231.8	66.1	151	303.8	88.3	191	375.8
44.4	112	233.6	66.7	152	305.6	88.9	192	377.6
45.0	113	235.4	67.2	153	307.4	89.4	193	379.4
45.6	114	237.2	67.8	154	309.2	90.0	194	381.2
46.1	115	239.0	68.3	155	311.0	90.6	195	383.0
46.7	116	240.8	68.9	156	312.8	91.1	196	384.8
47.2	117	242.6	69.4	157	314.6	91.7	197	386.6
47.8	118	244.4	70.0	158	316.4	92.2	198	388.4
48.3	119	246.2	70.6	159	318.2	92.8	199	390.2
48.9	120	248.0	71.1	160	320.0	93.3	200	392.0
49.4	121	249.8	71.7	161	321.8	93.9	201	393.8
50.0	122	251.6	72.2	162	323.6	94.4	202	395.6
50.6	123	253.4	72.8	163	325.4	95.0	203	397.4
51.1	124	255.2	73.3	164	327.2	95.6	204	399.2
51.7	125	257.0	73.9	165	329.0	96.1	205	401.0
52.2	126	258.8	74.4	166	330.8	96.7	206	402.8
52.8	127	260.6	75.0	167	332.6	97.2	207	404.6
53.3	128	262.4	75.6	168	334.4	97.8	208	406.4
53.9	129	264.2	76.1	169	336.2	98.3	209	408.2
54.4	130	266.0	76.7	170	338.0	98.9	210	410.0
55.0	131	267.8	77.2	171	339.8	99.4	211	411.8
55.6	132	269.6	77.8	172	341.6	100.0	212	413.6
56.1	133	271.4	78.3	173	343.4	100.6	213	415.4
56.7	134	273.2	78.9	174	345.2	101.1	214	417.2
57.2	135	275.0	79.4	175	347.0	101.7	215	419.0
57.8	136	276.8	80.0	176	348.8	102.2	216	420.8
58.3	137	278.6	80.6	177	350.6	102.8	217	422.6
58.9	138	280.4	81.1	178	352.4	103.3	218	424.4
59.4	139	282.2	81.6	179	354.2	103.9	219	426.2
60.0	140	284.0	82.2	180	356.0	104.4	220	428.0

Formula for converting Fahrenheit to Celsius: $°F - 32 \times \frac{5}{9} = °C$

Formula for converting Celsius to Fahrenheit: $°C \times \frac{9}{5} + 32 = °F$

APPENDIX III

MAINTENANCE OF LITHOGRAPHIC EQUIPMENT

Proper lubrication prolongs the life of any piece of equipment that has movable parts. You should apply red paint to the oil holes on such equipment so that you will not overlook any of them. Depending on its use, you should oil each piece of equipment daily with SAE No. 20 oil. Wipe off the excess oil with a rag. Do not let it run down the sides of the machine. Check all reservoirs on vacuum pumps to see that they contain sufficient oil.

VACUUM FRAMES

1. Clean glass every evening or when necessary. Use soft rags and commercial cleaner or ammonia water. Never use dirty rags or razor blades as they may scratch its surface.
2. Check vacuum pump reservoirs for sufficient oil.
3. Oil all moving parts, hinges, clamps, motors, etc., at regular periods.
4. Clean gaskets. Check for glaze.

ARC LAMPS

1. Clean all burned carbon from reflectors.
2. Check carbons for proper contact.
3. Check carbons for correct size.
4. Check carbon clamps to prevent slipping and bad contact.
5. Check wiring to carbons.
6. When replacing carbons, place clamps at outside end of carbons for good contact.

SINKS

1. Check all water valves for leakage or rusting.
2. Check spray pipes for leaks.
3. Check spray pipes for proper distribution of water.
4. Remove racks and check drains.
5. Remove all dirt or waste from bottom of sinks.

FANS

1. Oil motors of all fans each day or at regular intervals.
2. Clean dirt and excess oil from fans.
3. Check wiring connections periodically.

CAMERAS

1. Brush copyboard felt with foxtail.
2. Clean copyboard glass with cleaner fluid and soft rag. Rag must be clean and free of lint, buttons, and hooks.
3. Clean inside and outside of bellows with foxtail.
4. Clean ground glass with cleaner and soft, lint-free rag.
5. Clean and oil all gears with light oil. Remove all excess oil.
6. Oil and grease vacuum pumps and motors.
7. Clean lens with cleaner and lens tissues.
8. Clean glass halftone screen with cotton dampened in water, glass cleaning fluid, or alcohol. Do not use enough solvent to wet the screen, as too much might soak between the layers of glass and ruin the ruling. Dry with cotton and finish by breathing on screen and wiping.
9. Dust contact screens with soft photo chamois before storing them away. Clean with special organic chemical supplied by the manufacturer.

FILTERS AND SAFELIGHTS

1. Check wattage of bulbs in safelights.
2. Clean all filters with glass cleaner and soft rag.
3. Check all filters for scratches or breaks.

SINKS AND TRAY COOLERS

1. Check all water valves for leakage, sticking, or rusting.
2. Check all drains for proper working condition.
3. Check all chemicals that should be near sinks.
4. Check and oil motors and pumps on tray coolers.
5. Clean trays with potassium permanganate.

LINEUP AND RETOUCHING TABLES

1. Check fluorescent light for proper lighting.
2. Check wire connections.
3. Clean glass with window cleaner and soft rags.
4. Check all retouching tools and fluids. Replace as necessary.
5. Clean reflectors and paint with white enamel if necessary.
6. Oil moving parts.

ENLARGERS

1. Remove copy frame and clean with window cleaner and soft rags.
2. Remove lens and clean with lens cleaner and lens tissue.
3. Oil vertical slide shaft with light oil or vaseline. Remove excess oil.
4. Check electrical connections and bulb.
5. Clean all dimension slides of rust or corrosion. Coat with black paint if necessary.

TYPEWRITERS AND COMPOSING MACHINES

1. Oil all moving parts with light machine oil.
2. Remove excess oil with soft cloth.
3. Remove dirt and dust; clean keyboard with soft brush and type cleaner. Blow dust from machine with compressed air or bellows.
4. Check electric cord connections.
5. Check Varityper type plates. Clean with alcohol or type cleaner and fine brush.
6. Clean typewriter and IBM machine type with alcohol or type cleaner and brush.
7. Check ribbons.

DRAFTING EQUIPMENT

1. Clean T-squares with alcohol; tighten all screws.
2. Clean triangles with alcohol.
3. Clean and sharpen stripping knives on oilstones.
4. Clean brushes thoroughly in warm water; place brushes in jar with bristles up.
5. Clean pen points and lettering equipment with proper solvent.
6. Sharpen or replace engraving needles.

PRESSES AND OTHER EQUIPMENT

Maintenance procedures for presses and other equipment not listed here will be found in the chapters dealing with the specific equipment, or in the applicable manufacturer's instruction manual.

APPENDIX IV

GLOSSARY

aberration-focusing defect due to curvature of lens.

abrasive—hard material used for cutting into softer materials, as in graining lithographic plates.

absorption—the taking of one into another, as ink into paper to facilitate drying; or as in light rays, a filter passing its own color and holding or absorbing others.

accelerator—chemical used to shorten development time by speeding the action of the developer.

accordion fold—a term used in binding to describe two or more parallel folds which open like an accordion.

acetate sheets—sheets of thin flexible, transparent material used as a base for photographic film, and as a support for deep-etch layouts.

acetic acid—acid used as a counteretch in platemaking and as a short stop bath in negative processing. Glacial is over 99% pure. 28% acetic acid solution is made by diluting 3 parts glacial acetic acid with 8 parts of water. Vinegar contains 4% to 12% acetic acid.

achromatic lens—lens corrected to focus two of the primary colors on the same plane.

acid—compound containing hydrogen which can be replaced by certain metals to form salts. Acids are sour to the taste; they turn blue litmus paper red.

actinic—property of light rays which produces chemical changes in photographic emulsions.

activator—name given to various developers used in Ektalith processors, automated camera-processor platemaking machines, and so on.

additive process—process by which white light can be produced by starting with darkness and combining colored lights until white is obtained.

adhesion—an important requirement of inks to be used on nonabsorbent stocks, such as plastics or metal foils.

adjustable bed tracks—on automatic platen presses, adjustable tracks for the ink rollers.

Adlux film—trade name for slow-speed continuous-tone emulsion on frosted acetate used for making transparencies and for photographically converting screened copy to continuous-tone.

affinity—having a natural attraction for.

against the grain—folding paper at right angles to the grain of the stock.

agate—a unit of measure; approximately 5 1/2 points.

air bells—small bubbles of air that sometimes form and cling to the emulsion during film processing.

air brush—compressed air spray gun, used by artists to get smooth tint surfaces; especially useful in retouching photographs.

air control lever—on C&P automatic presses, a lever for opening and closing the feeder suction line.

air eraser—miniature sand-blasting apparatus, sometimes used by artists and lithographers for touch-up erasing on artwork or grained plates.

air suction inlet—on some ATF presses, an opening in the feeder suction line which must be closed to start sheets feeding.

albumin—protein substance used in making lithographic plates; normally derived from egg whites.

alcohol—volatile liquid solvent. Anhydrous alcohol is waterfree.

aline—to position type and cuts in a straight line.

alkali—soluble base compound which neutralizes acids to form salts. Alkalis have a biting taste and are slippery to the touch; they turn red litmus paper blue.

all-weather rollers—letterpress ink rollers made of a special composition which permits year around usage.

alpha cellulose—material used in making papers which require a strong, yet soft and flexible texture.

alum (potassium alum; aluminum potassium sulfate)—salt used to toughen colloid films in photography and as an ingredient in preparing lithographic plates for tusching.

alumina hydrate—an ink extender of very low specific gravity and almost transparent.

aluminum oxide—hard crystalline material used as an abrasive for graining plates.

ammonia process—development of a diazo image by the use of heated ammonia fumes; such as the ozalid process.

ammonium bichromate—red crystals which become light-sensitive when mixed with an organic solution such as albumin. Used in platemaking and photographic reversal processes.

ammonium dichromate—same as ammonium bichromate.

ammonium hydroxide—ammonia gas dissolved in water. Used to alkalize the light-sensitive coating in platemaking and in diazo development.

Angstrom unit—unit of measure, used to measure the length of light waves; equal to one ten-billionth of a meter (about 254,000,000 units per inch).

anhydrous—waterfree or without water, as anhydrous alcohol.

aniline printing—printing done with rubber plates and aniline dyes; also called "flexography".

animal blacks—ink pigment made by charring animal bones from which the oily and fatty matter has been extracted.

antihalation backing—coating of dye which prevents internal reflections from the acetate base of the film back to the emulsion.

antique finish paper—natural, rough surface on book and cover papers; may be wove (simulating cloth) or laid (ladder-like) in appearance.

aperture—opening through which light enters the camera.

apochromatic lens—lens corrected to focus all the primary colors on the same plane.

apron—margin, equal to page width, added to binding edge of fold-in to allow unfolding beyond page edge.

Aquamatic unit—trade name for water-to-ink dampening system on A. B. Dick presses.

arc lamp—light source in which an electric arc is formed between two carbon electrodes when current is applied.

Art Type—trade name for acetate lettering or shading sheets.

ASA Exposure Index—speed rating for film emulsions developed by the American Standards Association and recognized as standard by exposure meter, film, and flashbulb manufacturers.

asphaltum—nondrying substance used as a base or a protective coating for images on lithographic plates.

astigmatism—lens aberration occuring around the edges of a picture, making it impossible to focus both vertical and horizontal lines at the same time. An anastigmat lens is corrected for this fault.

author's alterations (AA's)—changes made by the originator after the material has been typeset.

automated cameras—cameras which load the film, make the exposure, and develop the film automatically.

automatic fountain trip—on offset presses, a device which stops the ink feed when the impression is off.

automatic pressure—see compensating pressure.

automatic throwoff—on automatic platen presses, a device which trips off the impression when a sheet fails to feed.

automatic trip—on offset presses, a device which trips off the impression and ink when a sheet fails to feed.

autopositive—emulsion which produces a positive image from positive copy. A yellow filter is generally used in making the exposure.

Autoscreen—trade name for an orthochromatic film which is designed to produce a screened image from continuous-tone copy without the use of a half-tone screen.

average gradient—contrast index determined by measuring the slope of a straight line drawn between the two points on the characteristic curve (D log E) which represent the maximum and minimum densities normally used in making negatives or positives.

back (of press)—feeder end.

backbone—bound edge of a book; also called the spine.

background—nonimage area of a print. Also discoloration or scum in that area. Photographically, the area surrounding the central object in a photograph.

backing away—term used to describe condition when ink does not follow the fountain roller.

back cylinder—impression cylinder.

back-etching—reducing the density of film positives or negatives with Farmer's Reducer.

back gage—on paper cutters, a fingered metal bar against which the paper is squared.

back lash gear—see split gear.

back light—in process camera work, to illuminate the copy from behind.

back pressure—see impression.

back-up—to print the reverse side of a sheet having printing on the front.

barrel—cylinder in which lens elements are mounted.

base—a support, such as glass or acetate for photographic emulsion; also a block or plate on which electrotypes are mounted for lockup; also see alkali.

base color—first down color printed on the press.

basis weight—weight of a standard size of printing paper in lots of 500 sheets (commercial standard) or 1000 sheets (Government standard). Book papers are sold on a basis size of 25" x 38"; writing papers, 17" x 22"; covers, 20" x 26"; bristols, 22 1/2" x 28 1/2"; index, 25 1/2" x 30 1/2"; tag, kraft, and newsprint, 24" x 36". See substance.

bastard size—not of standard dimensions.

batter—a bruised or low area in the surface of a blanket.

Baum folder—trade name for a roller-operated folding machine.

Baume—unit for measuring density of liquids.

beam—a large volume of light.

bearers—bands on each end of offset press cylinders that roll in contact with one another maintaining correct separation between cylinders.

bed—flat part of a letterpress press on which type form rests.

bellows—flexible, light-tight enclosure connecting the lensboard and the camera back.

bellows extension—see camera extension.

benday—term applied to tint effects, such as lines, dots or patterns applied to art, negatives, or plates.

bend of the plate—place where the plate is bent along the leading and trailing edges in wrapping it around the cylinder of the offset press.

Bijur central lubricator—trade name for a system of feeding oil to the main bearings of some offset presses.

bimetal plate—offset press plate consisting of two layers of metal. During processing, the top layer is etched away in the image areas to expose the bottom layer which is especially sensitive to grease.

bind—to join pages of a book together with thread, wire, adhesive or other means. Also to enclose them in a cover.

bite—(1) the amount of space by which the press grippers overlap the leading edge of a sheet; (2) the action of etch on metal, as in photoengraving; and (3) the affinity of paper for ink.

black printer negative—in color-separation work, a negative made with a yellow filter or a combination of filters. The plate made from this negative is run on the press in black ink.

blanket (offset)—sheet of vulcanized rubber on a fabric base, treated to prevent stretch when wrapped around the press cylinder.

blanket dust—mixture of French chalk and powdered sulfur used to relieve tackiness in the blanket.

blanks (paper)—paper boards ranging in thickness from 0.012 to 0.078 of an inch.

bleed—that portion of the image extending beyond the trim edge of the printed sheet; also spreading or running of ink.

blind—term used to describe condition when the image area of the plate will not accept ink.

block out—to mask or paint over with opaque the transparent portions of a negative that should not image on the plate.

blocking—nailing a letterpress cut to a block of wood.

bloom—coating which forms on rubber blankets in storage. It should be washed off before use.

blower—mechanism which supplies blanket of air to separate the top sheets from others in the paper stack of the press or folder.

blow up—enlarge photographically.

blueline—photographically-prepared image in blue lines on acetate, metal plates, or paper; used for paste-up or color-separation work.

blue key—a blueprint on glass or vinyl plastic of a design containing all elements with register marks which is used as a guide for stripping a flat of photographic elements of other colors to register.

blueprint—quick proof made from a negative or flat on blueprint paper; yields a blue image.

body (ink)—term referring to the consistency of the ink.

body gum—thick varnish used to stiffen inks.

body type—type used in the text or body of a printed page. See also display type.

bond ink—short, stiff ink made for printing on bond papers.

bond paper—hard-finished paper receptive to printing and writing inks, used for stationery, forms, etc.

book paper—paper suitable for printing books, catalogs, magazines, etc; may be coated or uncoated, in a variety of finishes, and may or may not be sized for offset printing.

border—ornamental or finishing rule used around the edge of printed matter.

box—to enclose a paragraph or heading with borders or rules.

brass rule—thin strip of rolled brass used for printing borders or lines in letterpress forms.

brass space—thin space used in justifying lines of hand-set type.

brayer—hand roller used in inking type forms for proofing; also the rollers on some C&P presses.

bristols—lightweight cardboards, as index bristols, mill bristols, and wedding bristols.

broad—in layout placing the top of the image at right angles to the greater dimension of the page. Generally in publications work, the head is placed at the left side of the page on both right and left hand pages.

brochure—pamphlet or booklet.

bromide—compound of bromine and another element. Silver bromide is a light sensitive salt used in photographic emulsions.

bronzing—applying bronze metallic powder to the wet ink of freshly printed sheets with a bronzing machine or by manual dusting.

brownprint—a photographic print or silver print which produces a brown image; not to include a sepia print or a contact print that has been toned. See also blueprint.

buckle control knob—adjustment on A. B. Dick presses for regulating the buckle of overfeed of the paper as it is fed into the cylinder grippers.

buffer—chemical agent used to control the activity of the developer.

built-in wrench—on some presses, a device for loosening the cylinder from the gear when raising or lowering the image on the paper.

bulk (of paper)—expression indicating the number of paper sheets per inch of a given paper weight.

bullets—dots used as ornaments in composition.

bump exposure—in making halftones with a contact screen, a highlight exposure made with the contact screen removed from the camera.

burn—to print (expose) a photolithographic plate with bright light in a vacuum frame.

burn out—to overexpose when printing a plate with a positive so that sufficient exposure can be achieved through dirty or less than totally transparent areas of the positive.

Burnishine Putz Pomade—trade name of offset press roller cleaning compound.

business papers—papers used for administrative uses, such as bonds, punch cards, safety papers, and mimeograph, and duplicator papers.

C&P press—trade name for a platen press manufactured by Chandler and Price; some are equipped with automatic feeders.

caking—build up of ink pigment on rollers, plates or blankets, caused by failure of the vehicle to hold the pigment in suspension.

calcium chloride—crystalline compound used in developing deep-etch plates.

calender—bank of rollers at the end of a papermaking machine through which the web of paper is passed to impart a smooth finish.

california job case—type case having compartments for both lowercase and capital letters.

caliper—device used to prevent more than one sheet from feeding into the press at a time.

caliper (of paper)—term denoting the thickness of paper, expressed in thousandths of an inch. Each thousandth is called a point or, less commonly though preferably, a mil.

calligraphy—a form of hand lettering frequently used on book jackets, title pages, cards, and letterheads. The calligraphic letter is based on the handwritten cursive alphabets of the 16th century.

cam—eccentric disk or wheel.

camera extension—distance from film to lens.

camera-processor—automated process camera and platemaker combined into one machine.

camera-ready—copy that is complete and ready to be photographed.

candle power—unit of measure of a light source.

caption—words entitling, defining, or explaining an illustration in one or more lines above the illustration. The term is often used loosely to refer to descriptive matter appearing below a picture.

carbons—compressed carbon rods of varying thickness and length used to produce arc illumination in camera and platemaking equipment.

carbon blacks (ink)—ink pigments consisting mainly of the element carbon made by partial combustion of natural gas.

carbon tetrachloride—colorless nonflammable fluid used as a solvent. It is dangerous when used without adequate ventilation and its use is prohibited aboard naval vessels.

cartography—the art of making maps or charts.

case—drawer for storage of type.

casein process—platemaking process similar to that used in making albumin plates.

casting copy—to calculate the space manuscript copy will occupy when set in type.

catchlights—neglible highlight areas, as in the whites of the eyes.

catch-up—localized tinting caused by inadequate or improper dampening of the plate on the offset press.

catcher pan—on small offset presses, pan below the conveyor tapes which receives sheets deflected by the caliper.

cat's whiskers—short pieces of wire or thin strips of metal used on feeders of some presses as separator fingers.

caustic soda—concentrated lye (sodium hydroxide); sometimes used to remove old images from press plates.

cellophane press—proof press designed to print on acetate.

cellulose gum—water-soluble substance; useful as a substitute gum. Made from wood fiber cellulose.

centerline—a short line applied to the copy, negative, or a flat and used to indicate the center of the trim margins of a form or all the forms on a press sheet. Also used for registration.

chain delivery—mechanism on some presses consisting of two endless chains with grippers mounted on bars which are stretched between them; used to transport the sheet from the impression cylinder to the delivery pile.

chalking—powdering or rubbing off of ink, due to overabsorbance of vehicle leaving insufficient vehicle to bind the pigment to the paper.

character count—an estimate of the number of characters including spaces between words in manuscript copy. It provides the means of determining how much space the text will occupy when set in type.

characteristic curve—curve denoting the response of a specific film emulsion to exposures of various durations and development of various durations.

chase—metal frame into which the type form is wedged (locked) before placing it on the press.

chemical fog.—See fog.

chemical graining—producing a rough surface on a metal plate by treating it with chemicals.

Chicago screws—trade name for metal screw posts used in bindery work in which a larger female threaded post is inserted through the binding hole and capped with a smaller, male threaded screw.

Chief—trade name for a series of offset presses distributed by the American Type Founders.

chinese white—artist's white water color used in retouching.

chipboard—rough surfaced cardboard used as backing for pads and tablets.

choke—same as caliper or two-sheet choke.

chroma—the degree of intensity from black to white; the composition of a color, defining its hue and the amount of black or white it contains.

chromatic aberration—failure of lens to focus all colors on the same plane, causing a colored outline or blur.

chromic dermatitis—skin disease; injury to human tissues caused by chromic acid and salts of chromium.

circular screen—glass halftone screen, circular-shaped to allow for rotating it to various screen angles in color work.

citric acid—mild acid used for developing and cleaning deep-etch plates.

clearing—the action of hypo in rendering the unexposed area of a negative transparent. Also removing fog from negatives or positives with reducer, etching needle, or any means.

coal tar dyes—artificial organic dyes used extensively in the manufacture of printing ink because of their brilliancy.

coated blanks—cardboards of two or more plies coated on one or both sides, used for signs, posters, tickets, etc.

coated paper—any paper to which surface coating has been applied.

cobalt drier—liquid drier resembling dark varnish; primarily a surface-type drier for use with dark offset inks; a fast drier used for single-color printing; provides a hard surface which resists rub.

cold color—color with a bluish or greenish cast to it; cold black has a bluish tint as opposed to a warm black with a reddish tint.

cold shot—shooting a screened original without using a halftone screen. Also called a screened pickup.

coldtype composition—any composition prepared by methods that do not include materials produced with letterpress typesetting equipment, such as typewritten or Varityped copy.

collotype printing—also known as "photogelatin printing". A printing process which uses plate images comprised of bichromated gelatin. Such images provide for the printing of continuous-tone because the gelatin has different degrees of ink and water receptivity. This process is limited to short runs.

collating—gathering single sheets or leaves in sequence.

colloid—organic substance, such as albumin, starch, or gelatin, apparently dissolved, but in suspension in a liquid.

color correction—any technique which alters the density in specific areas of a negative or positive and thus provides for more accurate color rendition; as dot etching or masking.

color-blind emulsion—photographic emulsion sensitive only to blue and violet.

Color Key (3M)—thin, light-sensitive color-coated acetate sheets for use in proofing multicolor jobs; colored coatings on these sheets match standard process colors. The sheets are exposed through separation negatives and developed with a chemical which dissolves the unexposed coating leaving a colored image.

color patch—often called color swatch. A sample usually attached to the original to show the precise color of ink required in printing the job.

color separation—the process of photographing each primary color of a full color original on a separate sheet of film. Also the preparation of art work for a multicolor job whereby an overlay is made for each color.

color transparency—transparent, full color photograph on film, as a color slide.

column inch—a space 1 inch deep by 1 column wide.

column rule—rule used as a dividing line between two columns of type.

coma—comet shaped distortion produced by the curvature of the lens.

combers—on some offset presses, wheels which buckle the top sheet in the feed pile to start the sheet separation.

combination art—artwork containing both line and tone work.

combination layout—line and halftone negatives or positives stripped onto the same flat. Also a flat containing a number of unrelated jobs.

combination plate—an offset plate imaged with both halftone and line work. Also a plate on which there are two or more unrelated forms for simultaneous printing.

compensating pressure—feature on some duplicators which allows the printing pressure to automatically adjust to varying paper thicknesses.

complementary colors—red and green; blue and orange; yellow and purple. When any two of the 3 primary pigment colors are mixed to form a secondary color, the remaining primary is complementary to the mixture. Any 2 colors of light that produce a neutral gray or white when combined are said to be complementary.

compositor—man who sets letterpress type or prepares coldtype composition.

comprehensive—a detailed layout with illustrations carefully drawn and type positioned. Often called a "comp".

concave lens—a lens with edges thicker than the center.

conjugate distance—the distances of object and image from the lens are called conjugate distances. For every position that an object may occupy with respect to a lens, there is a corresponding position for the image.

constant pressure—on the folder, rollers set to operate in rolling contact with each other. See also suspended pressure.

contact negative—same-size duplicate made by exposing a sheet of film to a film positive.

contact positive—same size duplicate made by exposing a sheet of film to a film negative.

contact screen—halftone screen made on safety base film; used in absolute contact with the film emulsion.

continuous feeder—type of feeder on some presses and folders which allows stock to be loaded without interrupting operation of the machine.

continuous tone—image consisting of blacks and intermediate shades of gray; not produced by a pattern of varying-size dots.

contrast—tonal range of photographs, negatives, artwork, etc. The degree of difference between the darkest shadows and the brightest highlights.

contrasty—having sharply-defined light and dark tones and limited or no medium tones.

control sheet—sheet used for checking progress of work.

controlled flash method—in camera work, the method whereby a halftone negative is produced with a two-step exposure—a detail and flash exposure.

conventional plate—term applied to albumin, deep-etch, or similar plates.

convex lens—a lens whose center is thicker than its edges.

cover papers—paper which serves for covering printed material, made in a wide variety to provide a desirable choice.

conveyor table—feedboard on the offset press.

conveyor tapes—endless fabric belts which carry the paper down the feed table to the printing unit of the offset press.

copy—manuscript which is to be set in type. Also material to be photographed.

copy fitting—calculating the proper type size and line width to accommodate copy within a given space.

copy plane—surface on which copy is attached for photographing; the copyboard of the camera.

core—in photography, the central portion of a halftone dot; on presses, the steel shaft on which rollers are formed; in paper, the wood or metal spindle on which paper is wound.

counter-etch—cleaning the press plate with a diluted acid solution to remove dirt and oxidation to make the plate surface more receptive to ink.

cover ink—stiff, full-bodied ink with good covering capacity; used chiefly for letterpress printing of cover stocks.

cover stock—paper used chiefly for booklet covers, tickets, etc.

C. P.—Abbreviation for chemically pure.

Craft-Tint—trade name for a chemically impregnated drawing paper whose pattern of lines and dots is brought out by brushing with chemicals.

creep—stretch, slippage, or any movement of the blanket that causes misregister during press operation.

crop marks—marks on an illustration to show which portion is to be reproduced.

cross carriers—on folders, revolving rollers which carry paper from one section to the next.

CRT typesetting machines—phototypesetting machines which utilize a cathode ray tube.

crystallization (ink)—term used to describe a condition which occurs when an ink dries so that succeeding colors will not adhere properly.

crystals—fixed forms caused by solidifying of an element or compound; though seemingly dry, they may contain moisture.

cut—metal plate having an etched image for letterpress printing. Also term used to describe any illustration used in a printing job.

cutlines—legends and captions.

cutting blade—washer-like cutting attachment used on some presses and folders.

cutting rules—steel rules taller than type high, used to cut windows and designs in letterpress printing.

cutting stick—hardwood or plastic insert in bed of paper cutter into which the knife passes after completing its stroke.

cyan—blue-green color.

cylinder brush—brush which rides against the impression cylinder to remove dust and lint and smooth wrinkles from the paper.

cylinder gap—recess or opening in press cylinder.

cylinder press—printing press having a flat bed for the type form or litho stone and a revolving cylinder against which the impression is made.

cylinder undercut—on plate and blanket cylinders, the difference in height between the bearer and cylinder body.

Dahlgren dampening system—trade name for a water-to-ink dampening system developed for use on the larger offset presses.

dampeners—press rollers used for dampening the offset plate.

darkroom camera—process camera with back built into the darkroom wall.

Davidson—trade name for small offset duplicators and folders.

dead—cancelled, finished; not to be used again; as a dead form.

deep-etch—lithographic platemaking process in which the image areas are slightly etched into the plate surface.

deflectors—on folders, a plate placed over the mouth of the fold plate to prevent the sheets from entering.

delivery arm—on automatic platen presses, a device which carries printed sheets from the platen to the delivery table.

delivery cylinder—see skeleton cylinder.

delivery grippers—metal fingers attached to a bar extended between two continuous chains which receive the sheet from the impression cylinder grippers and carry it to the delivery platform.

delivery platform—platform on which printed sheets are deposited in the press.

delivery table—on platen presses, table on which printed sheets are stacked as they are removed from the press.

density—measure of opacity, or the ability of a film to stop light.

densitometer—an instrument for measuring the reflection and/or transmission density of opaque copy or negatives.

density range (of halftone screen)—the range of tone which the screen can produce. Determined by subtracting the density reading of the shadow areas from the highlight density on the negative.

dermatitis—a skin disease characterized by an itching rash, swelling or roughening of the skin, or water pustules. In lithography, caused by photographic developers, chromium compounds, and solvents.

desensitize—making nonimage areas of the plate nonreceptive to ink by chemical treatment of the plate using gum solution or etches. See etch.

dessicated—completely dried; having all moisture removed.

detail exposure—halftone exposure capturing all the minute detail of the copy.

detector finger—device on press which kicks off the impression when a sheet fails to feed through.

detent pawl—locking device causing the impression to remain on as long as paper is fed through the press.

diaphragm—device used to control the amount of light admitted through the lens to the camera.

diazo compound—light-sensitive, coal-tar derivative used in coating presensitized offset plates.

diazo paper—paper coated with a diazo compound; usually developed by ammonia.

diffused light—light waves thrown back or reflected in several different directions.

diffusion transfer plates—uncoated aluminum or plastic plates prepared by exposing a special sensitized material, developing it, then passing the material and plate through pressure rollers. The image is transferred to the plate by pressure and diffusion.

dingbats—stars or ornaments used in type composition.

direct-image plates—plates which are imaged by typing, drawing, lettering or imprinting directly on the plate.

direct method (in color-separation)—a method which consists of making the halftone negative for each color directly from the original copy. See indirect method.

disk—circular plate, part of ink distribution system of platen presses.

display type—type larger than body type used to draw attention.

distortion—lens aberration in which straight lines appear curved.

distribute—to return hand-set type to proper compartments in the case.

distributor rollers—inking rollers which break down the ink by sidewise as well as rotary movement.

dolly—a platform on wheels.

doping—changing ink characteristics by adding driers, extenders, thinners, etc.

dot etching—reducing the size of halftone dots by etching with silver solvents.

double printing—combining details of two negatives by successively exposing both on the press plate in register.

double spread—facing pages in a publication laid out in such a manner that both pages combine to form a spread. A double spread is sometimes called a "two page spread" or a "center spread" (when located in the exact center of a booklet).

dowel—a short register pin of plastic or metal attached to a film support or plate. Used to position a film or flat for double printing or for step-and-repeat exposure.

draw—the action of a dull knife in cutting paper which draws the sheets away from the back stop of the cutter thus producing a somewhat concave rather than vertical slice.

drawdown—a test for ink color made by placing a small quantity of ink on paper and spreading it (drawing it down) with an ink knife.

drawsheet—top sheet of packing on platen or cylinder letterpresses. (See tympan.) Also brass sheet covering impression segment of Davidson press.

driers—additives used to accelerate drying of ink.

driver wheels—small detachable wheels which ride the conveyor tapes and help control the sheet as it travels down the feedboard of the press.

drop guides—see front guides.

drop-out—halftone negative in which dots have been eliminated (dropped out) from highlight and background areas, by exposure or development.

drums—large metal rollers in the inking system of the press.

dry brush—a drawing made on rough paper with very little ink in the brush.

dry offset—offset process using relief plate and no water.

dry scoring—scoring on platen or cylinder letterpress with ink rollers removed from press.

DSJ—model of Varityper composing machine which uses differential spacing and has a justifying feature.

Dubar—trade name for a plate lacquer used to strengthen the image.

ductor—roller in the inking or dampening system which alternately contacts the fountain and distributor rollers.

dummy—in layout, a preliminary sketch showing position of text and illustrations; in bindery, a blank sample showing size, shape, folding, and collating order.

duotone—a halftone that has its shadow detail printed in a dark color and its highlight detail in a lighter color.

duplicator—small offset press, such as a model 1250 Multilith.

dwell—Length of time that a roller is in contact with another roller or cam.

Dycril—trade name for a relief plate used in letterpress and dry offset.

eccentric—disk which rotates with an off-center action.

effective aperture—useful lens area; maximum diameter of lens diaphragm as measured through the front lens element; also known as the rated aperture.

ejector pins—on the Multilith, pins in the impression cylinder which rise automatically to push the paper from under the gripper fingers and out over the stripper fingers.

ejector rollers—rollers on the delivery end of the Multilith which force the paper into the paper receiver.

Ektalith—trade name for a diffusion-transfer platemaking process.

electrostatic plates—plates produced by an electronic process. See xerographic printing.

Electrofax—trade name of RCA for an electrostatic printing process.

electrotype—metal duplicate plate, made by electrolytic action, used in letterpress printing.

element—in chemistry, the basic form of matter which cannot be reduced to different substances by chemical means. Also an individual portion of a lens assembly.

elevator finger—on some folders, a device which regulates the height of the pile in the feeder.

elliptical dot halftone screen—contact screen which produces an elliptical dot instead of the conventional square dot.

em—a printer's measure, the square of the body of the type; e.g. 8 points by 8 points.

embossing—swelling of the offset blanket to form a relief image of the printing design due to absorption of ink vehicle. Usually disappears with washing or by evaporation. Also pressing an inked or uninked image in relief onto paper stock.

emergency trip—on offset presses, a handle or button used to throw off the impression and ink.

em quad—square space as wide as the point size of the type body.

emulsification—mixing of water in inking system or ink in dampening system; may cause gray image (water in ink) or plate scum (ink in water).

emulsion—suspension of light-sensitive salts in gelatin or other colloids, used for coating photographic plates and films; also suspension of fine particles of a solid or globules of a liquid in another liquid; e.g. ink globules in the fountain solution.

en quad—half the width of an em quad, also called "nut". Properly called a space as it is smaller than an em.

enamel stock—paper to which has been applied a smoothed coating. May be dull finished or high gloss.

English finish—uncoated book stock with relatively high bulk and smooth surface.

engraved blanket—blanket dented by pounding from stiff ink. The opposite of an embossed blanket.

engraving—line cut used in letterpress printing; also an intaglio printing process.

etch—chemical treatment of plate to make nonworking areas grease resistant. Also the solutions used to accomplish this.

expansion trucks—devices supporting the ends of ink rollers on platen presses which are adjustable to regulate the pressure between the rollers and type form.

expose—to allow light to enter camera and strike the film. Also to allow the light to strike the plate surface through the goldenrod negative layout.

exposure meter—a device used to measure light intensity.

extenders—mostly mineral products of chemical manufacture used to improve the working qualities of ink.

f-numbers—fixed values at which the aperture of the lens can be set. The values are determined by the ratio of the aperture to the focal length of the lens.

fake process—process by which color-separation negatives can be made from a set of retouched black-and-white photographs by changing screen angles.

Farmer's reducer—solution of potassium ferricyanide and sodium thiosulfate, used to lower density or clear fog in developed negatives by dissolving metallic silver.

far side—nonoperating side of press.

feed bar—a device used to transfer the sheet from the pile to the gage pins on automatic platen presses.

feedboard—on offset presses, table over which sheet travels on way to front guides; on platen presses, table which holds paper to be hand-fed into press.

feed cylinder—see transfer cylinder.

feeder clutch lever—lever which engages clutch and sets feeder in motion.

feeder control lever—lever which sets up suction to start sheets feeding and throw on impression on some ATF presses.

feeder platform—board or table on which paper is piled for feeding into press.

feed rolls—forwarding device on small presses used to move stock from front guides into impression cylinder grippers.

feed table—platform on which paper stock is loaded for feeding into automatic platen presses.

felt side (of paper)—smooth or top side; preferred side for printing. See wire side.

filling in (or filling up)—filling of areas between halftone dots or small letters caused by excessive ink or thin ink.

film processor—machine which automatically develops, washes, and fixes film in one continuous operation.

film speed—relative sensitivity to light.

filter—piece of colored glass, film, or gelatin used to separate colors, reduce glare or vary contrast. Also a material, such as cheesecloth, that allows certain dissolved materials to pass while holding back insoluble particles.

filter factor—the number of times an exposure must be increased when using a filter.

filter slot—opening in lens barrel for insertions of filters and special function stops. See Waterhouse stop.

fixer—photographic solution which stops the action of the developer, dissolves unexposed silver salts in the emulsion, and hardens the colloids. Commonly called hypo.

flare—nebulous patches of light caused by internal reflection in the lens.

flash—a supplementary halftone exposure of short duration made to introduce a fine, pin-point dot into the shadow areas.

flat—sheet of acetate or paper on which negatives or positives have been mounted in proper position for printing.

flatbed press—press on which type form or lithographic stone rests on a flat bed.

flat negative—negative with little contrast.

flat stitch—to staple or stitch along the edge; to side stitch. See saddle stitch.

flow—the ability of the ink to follow the fountain roller and level itself.

fluorescent lamps—low-pressure mercury arc lamps.

flush—even with the margin or even with the widest line in the column or page.

flywheel—on platen presses, a large wheel which builds momentum when the press is running and keeps operation smooth and even.

focal length—the distance from the lens to negative when the camera is focused on an object at infinity (100 feet or more). Also 1/4 the total distance between the film and copy when a process camera is focused for a same-size reproduction.

focal plane—position at back of the camera at which the image is focused and the film is placed.

focus—point at which light rays passing through a lens meet to form a sharp image.

focusing dial—device used to calculate proper camera settings for reductions and enlargements. Also used to determine proportional dimensions.

fog—silver deposit clouding all or part of the transparent areas of film.

fold-in—large sheet folded to fit into a bound book.

fold plate—narrow metal chute on folder which controls paper as it is buckled to make the fold. A separate fold plate is required for each fold.

fold plate stop—adjustable bar within the fold plate which can be set to control the width of the fold.

folio—page number.

font—complete assortment of type of one size and style.

form—type and cuts arranged in one or more pages, locked in a chase and ready for printing.

form rollers—on offset press, ink and dampener rollers which contact the plate. On letterpress, rollers which contact the type form.

format—size, shape, and general style of make-up of a publication.

Forms design machine—Varityper with leader-line assembly (forms attachment) which enables the operator to type continuous rules or leaders when preparing copy.

forwarding rollers—on offset press feeders, rollers which receive the sheet from sucker feet and force it onto the conveyor tapes.

Fotomatic—a tape-operated phototypesetting machine.

Fotosetter—a keyboard operated phototypesetting machine.

Fototype—trade name for cardboard letters used in copy preparation.

foundry type—type cast on hard metal for hand setting.

fountain—reservoir for water or ink.

fountain barrel—fountain roller.

fountain liner—paper liner for ink fountain of small presses.

fountain roller—roller which revolves in ink or water fountain.

fountain solution—chemical solution in water fountain of the offset press. Commonly called the "water".

fountain trip—see automatic fountain trip.

French chalk—see magnesium silicate.

French fold—an arrangement in which all of the pages are printed on one side of the sheet, the other side being left blank. The blank side is folded inward before making the other fold, as a greeting card.

frequency (of light waves)—the number of light waves generated in one second.

friction feeder—a type of feeder which uses a revolving friction wheel to forward sheets into the machine.

frilling—separation of film emulsion from the base along the edges.

fringe—in line and halftone negatives or positives, an extension of the opaque detail into the surrounding transparent areas as a zone of decreasing density. Usually microscopic in its dimension, but of sufficient magnitude in camera-exposed negatives to make the dot size or the body weight of characters dependent on the relative time of exposure.

frisket—stencil used in masking airbrush work. Also mask used in letterpress makeready.

front (of press)—delivery end.

front guides—pins or plates at the end of the feedboard for registering sheets on the press.

front matter—in publications work, that matter which precedes the actual text, such as the title page, preface, forward, and table of contents.

front stop—on the C&P automatic platen press, a plate at the front end of the feed table.

fugitive—term referring to an ink which fades.

furniture—wood or metal blocks, less than type high, used to block type in the chase and to fill blank spaces in forms.

fuser—in Xerographic printing, heating or vapor unit used in fusing the image to the plate or paper.

gage pins—guides which are inserted in the tympan for registering the sheets on a platen press.

gallery camera—horizontal camera, not connected to the darkroom.

galley—metal tray in which type is placed after being set. Also proof taken from galley of type before type is made up into page form.

galley press—proof press suitable for proofing long galleys of type.

galley proof—proof pulled from type contained in a galley.

gamma—measure of development contrast.

ganging—combination of unrelated jobs on a single press plate to save press time.

gap—see cylinder gap.

gather—assemble printed sheets in proper order.

gear streaks—parallel streaks or slurs across the sheet and at the same interval as gear teeth on cylinder; caused by difference in surface speed of cylinders. A term improperly applied to all parallel streaks.

gelatin—gluey colloid obtained by boiling animal bones.

ghost—reappearance on the same sheet of an image laid down near the gripper edge and repeated due to improper ink or dampener roller settings.

glaze—on ink rollers, hard shiny appearance caused by improper cleaning.

goldenrod—paper or plastic support for negatives used by the stripper in making flats.

gothic—class of type, usually a business-like letter without serifs.

grain—(1) texture and compactness of metallic silver particles in the photographic emulsion; (2) direction of alinement of fibers acquired by paper during manufacture; and (3) tooth or roughened surface on a metal offset plate.

graining—roughening the surface of a metal plate with marbles and abrasives to increase its capacity for holding moisture. Plates may also be grained chemically and with rotating brushes.

gravure—process for producing an intaglio printing plate.

gray contact screen—halftone screen used for both black-and-white and color-separation work.

gray scale—a strip of paper containing tones ranging from pure white to black with intermediate shades of gray. Used as a tool in contrast control.

gripper edge sheet guards—metal fingers which guide or channel the stock into the cylinder grippers.

gripper bite—the distance the grippers overlap the press sheet as they clasp it to draw it through the press.

gripper edge—the leading edge of the press sheet; the edge that is caught by the grippers as the paper is drawn into the press. Also the leading edge of the goldenrod layout or plate.

gripper margin—on the goldenrod layout, an amount of space allowed for the grippers to clasp the press sheet.

grippers—on offset presses, short, curved fingers which grip the paper and carry it through the printing unit. On platen presses, the long metal fingers which strip the paper from the type after the impression.

ground glass—frosted glass used at the back of the camera in focusing.

guide marks—a method of using crossline marks on the offset press plate to indicate trim, centering of the sheet, centering of the plate and so on, as well as press register in multicolor work. Not to be confused with register marks used for stripping elements to register.

guides—guides used in positioning or registering paper in the press.

gum arabic—dried sap from acacia trees. Soluble in water. Used to form a protective coating over the plate.

gumming up—applying a solution of gum arabic to the plate to prevent oxidation and to protect it from damage during washout or makeready operations.

gum reversal process—a platemaking process similar to deep-etch.

gum streaks—streaks produced by improper rubdown during gumming up; particularly noticeable in halftones.

gutter—the inside margin of a bound page extending from the image area to the binding edge.

hairline rule—in letterpresswork, a rule producing a fine printing line, approximately 0.003" thick.

halftone—a film, print, or plate in which details and tone value are recorded as photographically-created dots.

halftone ink—soft, fluid, letterpress ink used for printing halftones and for reducing stiffer inks.

halftone step scale—a series of uniform tint steps of increasing dot diameters photographically prepared on film. Frequently added to a flat and located to print in a trim margin of the press sheet. Used as a control to evaluate printing conditions throughout the press run.

halide—salts of chlorine, bromine, iodine, or fluorine. These elements are known as halogens.

halftone negatives—photographic negatives made by photographing the copy through a ruled screen. The screen breaks the image into a series of small dots of varying sizes which combine to give the appearance of continuous tone.

halftone screen—see screen.

Hanko Dampener—Cleaning solution for the dampening rollers.

hard copy—an enlarged print made from a microfilm image. Also the copy produced on a cold-type composing machine, such as the Justowriter at the time the tape is prepared.

Headliner—a photo-lettering machine.

head margin—the space between the edge of the image and the gripper edge of the press sheet.

hex nut—hexagonal (six-sided) nut.

hickey—any imperfection on the press sheet caused by dirt on the press; dried ink on the plate or blanket; picking; paper dust, etc.

highlight—lightest areas on the copy; darkest on the negative.

highlight exposure—one of the multiple halftone exposures made when copy has considerable tonal range.

highlight printer—in duotone work, the negative for the color plate, as distinguished from the shadow printer negative which is generally used for the black plate.

highlighting method—term applied to method of producing halftone negatives with a contact screen in which a highlight or bump exposure is used in addition to the flash and detail exposures.

high negative—dense, very contrasty halftone negative; has no pinhole openings in the darker portions.

holddown bars—metal bars which control the paper as it travels down the feedboard of the offset press.

hologram—film bearing a three-dimensional picture.

hone—abrasive stick for removing unwanted markings from metal offset plates.

horizontal camera—process camera whose bellows extends horizontally.

humidity—a measure of the moisture content of the air. See relative humidity.

hydrochloric acid—an acid used in counteretching some press plates.

hydrometer—an instrument for measuring the density of liquids.

hydroquinone—a chemical agent in photographic developers. The reducing agent.

hygrometer—an instrument for determining the amount of moisture in the air.

hygroscope—an instrument for measuring the moisture content in a stack of paper.

hypo—see sodium thiosulfate.

idler rollers—rollers whose function is to break down the ink before it reaches the form rollers.

illumination—the amount of light that strikes a surface.

image—the area of a plate which prints or reproduces.

impose—to arrange in the order specified by the copy, dummy, or layout.

imposition—a plan for placing of type forms or negatives in proper order so that pages will be in desired sequence after printing and folding.

imposition chart—a piece of blank paper the size of the sheet to be printed, numbered and folded as it will be in the bindery after printing. Used in make-up to show where each page should go in relation to the other pages.

impression—inked image printed on paper as it runs through the press. Also the squeeze between the impression cylinder and the blanket.

impression cylinder—on an offset press, the cylinder that carries the paper into contact with the blanket.

impression lever—a lever found on some presses for bringing the cylinders together so that the image will print.

impression segment—on the Davidson duplicator, the impression side of the impression-plate cylinder.

imprint—to add identification or other copy to a previously printed sheet.

inching the press—jogging or moving the press by degrees.

indirect method (in color separation)—method in which continuous-tone positives are made from the separation negatives. These positives are corrected as necessary and then copied as transparencies in producing the final halftone negatives or positives.

initial letters—large capital letters used at the beginning of a paragraph.

ink fountain—a reservoir designed to feed the correct quantity of ink to the press rollers.

ink mileage—ink consumption on a given job.

insert—in binding, collecting and inserting signatures one into another for saddle stitched books. Also a small negative stripped into a large one.

insertion device—device used to move the sheet into the cylinder grippers after the sheet is stopped by the front guides. May be a roller, a transfer cylinder, or swing grippers.

insert—a small picture inserted into a larger one.

intaglio printing—type of printing done from plates which have the image etched below the printing surface as in engraving and gravure.

integrated tone density—in halftone work, the density or tone created by the halftone dots and the transparent areas around them.

intensify—to increase the density or contrast of each silver particle in the film emulsion by adding silver compounds or metals such as mercury.

intermediate—something utilized between two stages in the process of production, as a film negative being the intermediate between camera copy and the plate.

Intertype—a typesetting machine similar to the Linotype.

iodine quartz lamps—incandescent light bulbs filled with iodine vapor.

iris diaphragm—see diaphragm.

italics—a class of type consisting of slanted letters.

JCP—abbreviation for the Joint Committee on Printing, Congress of the United States.

job ink—letterpress ink used for general work.

job jacket—protective covering or envelope used for routing jobs through the shop and for filing them after the work is completed.

job press—see platen press.

jogger—see side guide.

joggers—metal plates that move back and forth on the delivery table of the press to keep the stack of printed sheets even.

jogging—jarring paper to aline and stack sheets in an even pile.

journal—the shaft at the end of the cylinders and rollers. The part that rides in the bearings.

journeyman—a skilled craftsman; one who has finished his apprenticeship.

justify—to adjust the space between words (or letters) to make all lines come out to the same length.

Justowriter—a coldtype composing machine.

kern—a part of the face of a type-cast letter that projects beyond the body.

key flat—flat used as a master or guide in stripping other flats of the same job.

key plate—the plate used as a guide for registration of other colors; the plate with maximum detail.

kicker—small, hand-fed platen press.

kill—to cancel.

kiss (pressure)—the minimum pressure at which proper ink transfer is possible.

Kluge—platen press. Usually equipped with an automatic feeder.

knee—part of a composing stick which can be moved in or out to control the length of the lines (See stick.)

knife folder—folding machine which employs a knife-like bar to start the crease in the sheets.

Kodak graphic arts computer—kit for determining the density range of your screen, the density range of the copy, and the exposure times required for copy of different density ranges.

lakes (ink)—pigment dyes containing mineral ingredients.

laketine—a colorless reducer used in lithographic inks to reduce color strength.

laminate—material made up of two or more layers pressed together, usually with an adhesive, as plastic laminated to a sheet of printed matter.

lamp blacks (ink)—pigment made from the burning of various oils rich in hydrocarbons.

latent image—dormant image which becomes visible during film or plate processing.

law of inverse squares—a rule stating that the amount of light of a given light source falling on an object varies inversely as the square of the distance from the source to the object.

lay—the correct positioning of subjects on the press plate or printed sheet.

lay sheets—sheets run during makeready in setting up the press.

layout—preliminary sketch, showing size, position, color of text, and/or illustrations.

lead (pronounced led)—a thin (2-point) strip of metal used for spacing between lines of type. Leads are available in 1-, 3-, and 4-point thicknesses also.

leader—a row of dots or dashes (......).

leading (pronounced leeding)—front or top edge, as leading edge of plate or blanket.

ledger—smooth, strong paper which readily accepts printing and writing inks. Used for bookkeeping records requiring permanence and frequent use.

legend—words entitling, defining, or explaining an illustration in one or more lines below the illustration.

length (of ink)—the fluidity or flow of ink.

lens—a piece of optical glass or a series of glass elements arranged to focus the rays of light.

Leroy—a mechanical lettering set.

letterpress printing—printing from raised surfaces, such as type and cuts.

letterset—name applied to dry offset printing from plates having a relief image.

letterspacing—inserting a space between each of the letters in a word.

lift—a small stack of paper. Paper is loaded into the cutter and press in small lifts.

light integrating device—mechanism which measures the intensity of light falling on the sensitized material and automatically alters the timing to ensure that each exposure is identical with the others.

line copy—copy, either text or art, suitable for photographing without the use of a halftone screen.

line gage—rule graduated in picas used by printers for taking measurements.

line negative—a negative made from line copy containing only solid blacks and whites.

linen tester—a fixed-focus magnifier.

Linofilm—coldtype composing machine developed by the Mergenthaler Linotype Co.

linoleum cut—hand-carved letterpress cut, consisting of a wooden block with a surface layer of linoleum in which the design is carved in relief.

linomatic feed—on DS and DSJ Varitypers, a device used for controlling spacing between lines.

Linotron—electronic typesetting machine which produces photographic images of the letters by means of a cathode ray tube; capable of operating at very high speeds.

Linotype—trade name for a typesetting machine which sets a line of type in one piece (called a slug).

linseed oil—oil obtained from seed of the flax plant. A drying oil used in mixing inks. Boiled linseed oils are called varnishes.

lithographic needle—negative engraving device.

lithotine—a lithographic solvent.

litmus paper—paper coated with a dye that turns red in contact with acid and blue in contact with a base.

live form—type form still in use or to be used.

lock up—process of locking type forms in the chase.

logarithm—the logarithm of a number is the power to which another number, the base, must be raised to give the number first named. For example in the equation $10^2 = 100$, 2 is the logarithm of 100 and 10 is the base.

long ink—ink that is stringy like molasses.

long scale film—film having an emulsion that will record a wide range of tones.

low negative—a halftone negative that is too thin with no opaque pin-point dots in the shadows.

lower case—small letters as distinguished from the capitals or upper case.

Ludlow—trade name for a slug-casting machine for which the matrices are set by hand. (See also mat.)

luminous objects—objects, such as the sun, which generate light.

lye—sodium hydroxide. See caustic soda.

M—designation for 1,000 sheets or impressions.

machine direction—the direction of the grain in paper as determined by the forward motion or flow of the paper machine. Also called "grain direction."

magazine—the feed pile unit of the Kluge press. Also the matrix holder of the typecasting machine.

magenta contact screen—a magenta colored contact screen used for making halftone negatives. See contact screen.

magnetic ink—ink having a metallic base which allows for electronic sorting in data processing work.

magnesium silicate (French chalk)—powder used to relieve tackiness of offset blankets. Also used in platemaking. Talcum powder is a form of magnesium silicate.

Magnetic Tape Selectric Composer—IBM selectric typewriter with proportional spacing which produces a magnetic tape when hard copy is typed. Tape can be used to produce finished justified copy.

Magnetic Tape Selectric Typewriter—IBM selelectric typewriter which produces a magnetic tape when the hard copy is typed.

makeready—preparation of the press to obtain proper printing impression.

make-up—arrangement of type and cuts into colums and pages by the printer.

margin line—a line ruled on a layout to denote the limits of the work on the page.

mark up—to write up instructions, as on a dummy.

mash—a depression or rupture of the blanket surface caused by folded, creased or rumpled sheets going through the press. Also called "smash."

mask—to protect areas of a sensitized film or plate from exposure to actinic light by the use of such materials as goldenrod or red paper, aluminum foil, etc. Also a controlled, low density continuous-tone positive or negative used to correct the tone range or color errors in a negative in color-separation work. The negative and its masks are registered together and then photographed as a unit when making a corrected halftone positive.

masking—protecting or blocking out parts of the copy or negative.

master—an original from which copies can be made.

mat (matrix)—(1) a brass mold used in casting letters on the Linotype, Intertype, or Ludlow; (2) paper mache mold used in casting stereotype plates; (3) a direct-image offset plate.

matte-finish—in photography, photo having a rough or textured surface, as opposed to a glossy finish. On acetate, a frosted or ground-glass-like appearance.

measuring bar—device used in positioning the front stop of the feed table on the C&P automatic platen press.

mechanical—a complete piece of copy for reproduction that consists of an accurate assembly of paste-ups of text, display matter, line drawings, and illustrations.

mercury vapor lamp—an enclosed light source containing mercury, sometimes used to expose plates or as an illuminant for cameras.

meter units—connections at the end of the oil tubes on the larger ATF presses and some Harris presses.

meter-candle second—unit of exposure used in making sensitometric measurements of film emulsions in preparing characteristic curves; equal to the exposure produced by a light source of one candlepower in one second at a distance of one meter from the sensitive surface.

metol—a chemical agent in photographic developers; an energetic reducing agent.

Micarta roller trucks—trucks used on the rollers for the Kluge press.

Micromatic ink distribution—ink system used on some C&P presses.

micrometer—a precision instrument used for measuring the thickness of the plate and blanket.

middletone—any of the various tones in photographic copy ranging between black and white. Also a halftone exposure.

mitering machine—in letterpress work, a device for cutting borders and rules at an angle so as to form perfect corner joints.

Moiré—a disturbing dot formation caused by rescreening a printed halftone.

melleton—cloth covering used on the dampening rollers of the offset press.

monochromatic film—film whose emulsion is sensitive to the blue and violet end of the spectrum only; also called regular or blue-sensitive film.

monochrome combination—in presswork, a two-color job, one of the colors being a dark color and the other a tint of the first, as blue and light blue ink.

Monophoto—coldtype composing machine developed by the Lanston Monotype Co.

Monotype—typesetting machine which sets lines of individual letters, as compared to slugs produced on the Linotype.

montage—see photomontage.

mortising—cutting out a portion of a letterpress cut so that type can be inserted into the cut.

mottling (of ink)—dirty or speckled appearance of print due to dirty ink, nature of ink pigment, insufficient printing pressure, excess tack, or excess cutting of ink.

mourning bands—ink pigment adhering to molleton dampener covers in the form or a ring or band, usually on the ends of the rollers.

Mullen dampening system—dampening system for offset presses in which water is fed to the plate directly from the dampener fountain roller, and the excess water is drawn off by a vacuum unit before the plate reaches the ink rollers.

multicolor presses—presses capable of printing more than one color in a single run.

Multilith—trade name for a small offset press.

multiple sheet choke—see caliper.

nap—rough, fibrous surface of cloth, like that found on towels.

near side—operator's side of press.

needle—steel points of various cross-sectional shapes (square, round, oval, etc) encased in a pencil-like wooden holder. Used to mark, scrape or engrave film or press plates.

negative-working plate—plate coated with a light-sensitive material which is intended for printing from a negative layout.

news ink—soft, fluid letterpress ink suitable only for absorbent papers.

N.F.—abbreviation for National Formulary.

NCR paper—"No carbon required" paper manufactured by the National Cash Register Co., having a chemical coating on the back of one sheet which combines with the coating on the front of another sheet to produce a duplicate copy on the second sheet when pressure is applied to the first.

night latch—on some presses, lever used to release tension on ink or water rollers during long press shut-down periods.

nitric acid—acid used diluted as a counter-etching solution.

nonworking areas (of plate)—the nonimage areas.

notch—half "V" cutouts along the margins of a goldenrod flat to locate the gripper line and center line of the flat in platemaking.

numbering machine—device used for printing consecutive numbers in letterpress work.

offset—transfer of ink from a freshly printed sheet to the back of another when they are stacked together. Also a form of lithographic printing.

offset paper—book paper, made for offset printing. Offset paper may be printed by letterpress, but not all book papers may be printed by offset.

one-to-one shot (1/1 or 1:1 shot) see same-size shot.

opaque—a substance used to paint out areas of negatives.

opacity—a direct measurement of the extent that a photographic image will prevent the passage of light. Opacity is the reciprocal of the percentage of light transmitted. Density is the natural logarithm of the opacity.

open—slightly underexposing and developing a halftone negative so that the dots will be slightly smaller than those normally obtained. An open negative will result in a fuller or darker printed illustration.

open press—hand-fed platen press.

optical center—spot which the eye first strikes when viewing a page. About two-fifths of the way from the top and slightly to the left of the actual center.

organic—term used by chemists to indicate that a substance consists primarily of compounds of carbon in conjunction with a few other elements.

original—copy submitted to the printer for reproduction.

orthochromatic film—film whose emulsion is sensitive to all colors except red.

oscillating rollers—rollers which move back and forth side-wise as they rotate.

oscillating suction head—on some models of the Harris press, a revolving suction wheel which picks up the sheet and forwards it to the conveyor tapes.

outline halftone—a halftone from which the background has been cut away or eliminated.

overburn—double burn on the plate.

overfeed—buckle in sheet formed when edge of stock is forced against the cylinder pins or grippers.

overlay—a sheet of acetate or tracing paper fastened over the original copy to indicate position and color of various elements.

overprint—in platemaking, the exposure of a second negative on an area of the plate previously exposed to a different negative. A method of combining a line and halftone image on the plate.

oxidation—corrosion or rust. Slow drying will cause some press plates to oxidize.

Ozalid machine—trade name for an ammonia process print-making machine which produces same-size copy from translucent or transparent originals on diazo-coated paper.

ozalid paper—see diazo paper.

packing—in letterpress work, sheets used for building up under the drawsheet on the platen press. In offset work, the sheets used behind the blanket or plate.

packing-down—a gradual decrease in gauge of a blanket from when first put on the press that requires repeated additions of underpacking. Also called "sinking."

padding cement—rubbery substance used in binderies for padding books.

page spread—two adjacent pages creating a single unit for the reader, as an illustration covering two facing pages.

panchromatic film—film having an emusion sensitive to all colors, but least sensitive to green.

paper conditioning—paper treatment to match conditions from storage to pressroom.

paper dampener covers—parchment covers used on dampening rollers in place of cloth coverings.

paper grain—the position of fibers in the paper.

paper line—the same as clamp margin.

paper negatives—negatives having a lacquered or transparentized paper base.

paper plate—see direct-image plate.

paper receiver—delivery unit on smaller offset presses.

paper stop bar—fingered metal bar found at the end of the feedboard on some presses for stopping the paper before it is caught by the cylinder grippers.

parallel folds—one or more folds made in the same direction, as an accordion fold.

paralleling the cylinders—adjusting two cylinders so that they come together with equal pressure at both ends.

parallel rule—double hairline rule.

Paratone—trade name for acetate lettering or shading sheets.

paste drier—lead or manganese resinates or linoleates ground in a varnish. Used mainly as a drier for colored inks.

paster—an attachment used on the folding machine for pasting up booklets.

pasteup—assembly of all elements in proper position before photographing.

pawl—a sliding pin which drops in the notches of a ratchet wheel so as to permit motion in only one direction.

Payzant pen—a type of lettering pen.

pegboard—a mechanical system for positioning a set of negatives or positives to produce a flat. Each film is perforated with two or more holes that are referenced to the location of the printing design and its trim margins. The films are positioned over pins that are permanently located in large plastic or pressed-board sheets in accordance with standard layouts or signature arrangements. They are then taped together to form the flat.

pencil—a narrow cylinder of light.

penetration (ink drying)—drying by absorption into the material.

penumbral—shadow halftone theory.

perfect (or adhesive) binding—binding where pages are fastened by adhesive, as in the case of a telephone directory.

perfecting press—press capable of printing on both sides of the sheet in a single run.

perforating—piercing the paper with a series of tiny dots or slits.

perforating blade—washer-like perforating blade (similar to the cutting blade) used on the folding machine.

perforating rules—steel rules (taller than type high) used for perforating on letterpress presses.

pH (hydrogen ion concentration)—the degree of activity of acid or alkali in a solution.

phosphoric acid—acid used in plate etches and fountain solutions. Issued in 85% concentration.

photocomposition—the photographic composing of text matter through the operation of a keyboard. This directly or indirectly exposes the characters from photomatrices onto photographic film or paper.

photocomposing machine—machine used in commercial plants for step-and-repeat work.

photoelectric scanner—electronic machine capable of producing continuous-tone or halftone negatives or positives or letterpress cuts from original copy mounted on a cylinder and scanned with an electric eye. Scanners are also used for producing color-separation work.

photoengraving—etching metal plates to cause the image area to stand in relief. Also a term applied to a cut made by this process.

photolettering machines—composing machines using a photographic process for turning out finished lettering.

photomontage—a composite picture made from separate photographs pasted together.

Photon—a disk-operated phototypesetting machine.

photo-resist plates—grained zinc or aluminum plates coated with an organic plastic solution.

Photosetter—coldtype composing machine developed by the Intertype Corporation, similar in some respects to the Linotype and Intertype.

Photostat Offset Duplicator, model 1115—press distributed by the Itek Corporation.

photo-type—see foto-type.

phototypesetting machine—composing machine that produces type composition by photographic methods.

pi-spilled type.

pica—printer's measure. 1/6 of an inch or 12 points. See points.

pica gage—same as line gage.

picking—lifting of particles of the paper by the blanket due to excessive tackiness of the ink.

pigment—ingredient supplying color to ink.

pile feeder—type of feeder found on some presses and folding machines. Cut sheets are stacked on the feed table and are fed into the machine a sheet at a time by suction feet or a rotating suction wheel.

pile height governor—a device which controls the height of the paper stack as the stock is fed into the press or folder.

piling (ink)—ink building up on blanket instead of transferring to the paper.

piling bars—bars at the sides or corners of the feed table of the press. Used for steadying feed pile and as a guide in reloading the press during a run.

pinholes—small transparent holes in the opaque portions of a negative.

pitch diameter—rolling diameter of a gear.

planer—wooden block used to tap down uneven letters in a letterpress form before it is locked in the chase. Also a felt-covered wooden block used in taking proofs directly from the locked form.

planography—form of lithography.

plastic binding—a patented bookbinding process.

plate—in offset work, the grained zinc or aluminum sheet carrying the image; in letterpress work, a cut or duplicate in one piece of metal of a form, page, or illustration.

plate cylinder—the cylinder on a rotary press to which the printing plates are attached.

plate tightening dial—device found on some presses for drawing the plate taut on the cylinder.

platen—the flat part of the platen press which carries the paper against the type to make the impression.

platen press—printing press on which the impression is made when a flat surface called the platen pushes the paper against the type. A job press.

plucking—see picking.

plugging—filling in of halftone shadow areas in developing the negative or in printing.

ply—refers to the number of layers of fabric in the blanket's construction. Also a term used to express the thickness of card stock, bristols, or blanks.

point—printer's unit of measure. One seventy-second of an inch. Twelve points equal one pica.

Polaroid screened print—halftone photographic print made with a Polaroid camera having a halftone screen inserted between the lens and sensitive material. Prints are generally pasted together with line copy and shot as line in making the final lithographic plate.

Polyfibron blanket—blanket consisting of two separate parts: a fabric base and an adhesive-backed surface.

polymerization—ink drying process in which the molecules of ink become bound together in a matte-line pattern to resist rubbing.

positive-working plate—plate coated with a light-sensitive material which is intended for printing from a film-positive layout.

potassium cyanide—poisonous salts used for wet plate reduction and for local removal of the albumin image from the press plate.

potassium ferricyanide—salt used in preparing photographic reducers and blueprint solutions.

powdering—practice of dusting a blanket with powder after washing to offset tackiness. Also used to describe ink that dries but pigment does not hold to stock. Sometimes called chalking.

precipitate—a solid substance thrown out of a solution by physical or chemical reaction.

precipitation (ink drying)—a group of inks that contain solids that cannot coexist with water. Inks drying by precipitation are steam set.

presensitized plate—precoated plate which can be printed photographically from line or halftone negatives.

preservative (photographic)—a chemical which controls developer oxidation (as sodium sulfite).

press board—a tough, springy cardboard used for packing on platen presses.

pressure-transfer lettering—lettering printed on acetate sheets which will transfer to a sheet of drawing paper when rubbed on the back.

primary colors—the primary colors for additive combinations consist of blue-violet, yellow-green, and red-orange light, and the secondary colors consist of blue-green (cyan), yellow and magenta. Color scientists consider these secondary light colors to be the true primary pigment colors instead of the traditional red, yellow, and blue, and these colors are used by printers as the basis for mixing colored inks and for process color work.

printer—a processed lithographic plate. Each plate in a multicolor job is described according to the color it will print, such as the "blue printer" that will be printed on the press with blue ink.

process camera—copying camera used in reproduction work.

process color—a loose term for full color printing.

progressive proof—set of proofs generally run on the same paper stock as the finished job, in which each color is shown by itself and in the proper printing sequence. In full-color printing, the series would normally be yellow; red; red on yellow; blue; blue on red and yellow; black; black on blue, red, and yellow.

projection printer—enlarger.

proof—a trial printing impression for correcting errors.

proof planer—see planer.

proof press—small press used for pulling proofs.

proofreading—checking proofs against copy to assure the accuracy of composition and all details of typography.

proportional spacing machine—a composing machine having a standard typewriter keyboard, but differing from a typewriter in that it gives each letter only the amount of space it actually requires.

pumice stone—an abrasive used for polishing.

punch register system—system involving the use of prepunched holes in the flat and plate and a set of plastic pins or buttons which are used in registering succeeding flats, positioning the image on the plate, and positioning the plate on the press.

quad—a piece of metal less than type high used as spacing material in typesetting.

quadding out—filling out the last line in a paragraph with spaces and quads.

quire—paper measure, 24 sheets.

quoin—locking device for wedging type and cuts in the chase.

quoin-type plate clamps—type of plate clamp used on some ATF presses.

rag paper—high grade paper made from rags.

ratchet wheel—a wheel having teeth which are engaged by a pin that permits motion in only one direction. See pawl.

ray—the smallest portion of light, generally represented by a straight line.

ream—technically 20 quires or 480 sheets; commonly 500 sheets. A printer's perfect ream is 516 sheets.

red printer negative—in color separation work, a negative made through a green filter. The plate made from this negative is run on the press in red ink.

reducer—(1) varnishes, solvents, or oily or greasy compounds employed to bring ink or varnish to a softer consistency; (2) in photography, the term refers to chemicals used to reduce the density of negative or positive images or halftone dots; (3) a substance which robs another of oxygen.

reducing—process of decreasing or clearing fogged areas of a negative.

reference marks—registration marks.

reflection copy—any copy that is photographed by light reflected from the copy into the camera. Includes all types of opaque copy. See also transmission copy.

reflex negative—diffusion-transfer negative produced by contact printing.

refraction—bending of light rays when passing obliquely from one transparent material to another.

register—agreement in location of successively printed images.

register finger—on the C&P automatic press, small metal finger which moves the sheet against the gage pins.

register marks—marks, usually crosses, placed on original art or photographic negatives or positives to aid in positioning the images in multicolor or double printing. Also called "cross marks" or "reference marks."

register table—that part of the folding machine that corresponds to the feedboard on the offset press.

reglets—wooden strips used in blocking type forms in the chase, usually 6 or 12 points thick.

regular film—film having a color-blind emulsion.

relative aperture—ratio of the lens opening to the camera extension.

relative humidity—the percentage of saturation of a unit of air. A relative humidity of 40% indicates that the air contains 40% as much moisture as it could carry if it were 100% wet at that temperature.

relief printing—method of printing in which the printing surfaces are raised; e.g. letterpress.

repro—term used to describe a page of reproduction copy, as a repro proof.

reproduction proofs—proofs which are to be copied with the process camera for use in making plates or cuts.

rescreener—diffusion filter used in copying halftone clippings to diffuse old halftone dots and eliminate danger of moire.

resin—solid or semisolid substance used to strengthen plate images.

resolving power—the ability of the film or lens to reproduce thin lines without loss.

Respi halftone screen—gray or magenta contact screen which produces a double dot on the negative. Respi screens are also available in glass.

restrainer—chemical agent added to retard the action of the developer.

reticulation—a network of cracks in the film emulsion produced by highly alkaline developing solutions or by forced drying.

retouching—process of painting in details, painting out backgrounds, etc., in photographic copy.

reverse—anything that is negative in tone value to the original copy.

reversal—see solarization.

reverse combination—white lettering against a dark background.

rider roller—metal or plastic rollers in the inking mechanism which break down, transfer, and distribute the ink.

right-angle fold—a second fold made at a right angle to the first (parallel fold) in the folding machine.

roller-operated folder—a type of folding machine operating with a series of metal folding rollers. See also knife folder.

rolling up-applying ink to the press plate with a hand roller.

roman—class of type with open, clean cut letters and serifs. Vertical type, as distinguished from italics.

Ross board—illustration board with a pebbled or roughened surface.

rotary press—a fast press using curved printing plates and a curved impression cylinder.

rotogravure—a mass production gravure (intaglio) printing process using a rotary press.

rough—a layout in preliminary, rough form.

routing—cutting away high metal in nonimage areas of a letterpress cut.

rubber cement—pure rubber dissolved in benzol.

rubber shoes (tips)—rubber tips placed over the regular metal sucker feet to provide greater traction in feeding the sheets into the press.

rub up—applying a liquid ink to all or part of a press plate with a rag or wiper; used to restore ink receptiveness.

Rubylith—see Ulano Rubylith.

rule—a thin strip of metal the height of ordinary type, used to print lines and borders on a letterpress job.

ruling—the number of lines per inch in a halftone screen.

run—the number of copies to be printed on a particular job.

run around—type set to fit around an illustration in a column.

running safe—leaving the offset press with the plate cylinder gap facing the dampeners during shutdown periods.

running true—during makeready operations, allowing the press to run until the water and ink have worked out to an even feed.

run over—to carry words from the end of one line to the beginning of the next.

saddles—latch-like devices into which the rollers fit when they are put on the platen press.

saddle stitch—to bind a publication along the center fold.

safelight—a colored light used for darkroom illumination.

safety papers—stock used for printing bank checks, money orders, etc., to prevent alteration.

salt—a compound formed when the hydrogen in an acid is partly or wholly replaced by a metal. The names of salts of ous acids end in ite; salts of ic acids end in ate with a few exceptions.

same-size shot—term used to describe a negative image that is the same size as the original copy.

sans serif—term applied to all type faces having no serifs. Also the name of a particular face of type.

scale—a linear measuring instrument, as a gray scale, halftone step scale, and so on.

scaling—a simple plan for proportional reduction or enlargement of copy.

score—to break or dent the stock so that it can be folded easily.

scoring blade—a washer-like blade used for scoring sheets on the folding machine.

scoring rule—steel rule used for scoring stock on letterpresses. Brass rules may be used for this purpose when scoring rules are not available.

scratchboard—drawing board having a smooth clay surface. Drawings made on it are afterwards scratched with a knife to provide highlights.

screen—(1) glass. Two pieces of optical glass ruled in opposite directions. Used in halftone reproduction. (2) Contact. A screen printed on safety base film and used in contact with the sensitized material. (3) A term used to denote the particular ruling to be used. For coarser work 50 to 85 line screens may be used, as with newspaper reproductions. Finer work takes rulings up to 300 lines per inch.

screen angle—the angle at which the screen is turned to avoid a noticeable dot pattern. A 45° angle is generally used for black-and-white work. In color work, the angle must be changed for each color.

screen compensator—a sheet of glass having the same refractive qualities as the glass halftone screen. Used in the camera during the exposure for the line portion of combination negatives.

screen distance—see screen separation.

screening—photographing through a halftone screen.

screenless lithography—a method whereby a continuous-tone effect is created on the printing plate without the use of a halftone due to the distribution of coating thickness formed by the random peak and valley structure that vary in size on the plate.

screen separation—the distance between the screen and the film, measured in sixty-fourths of an inch.

screen tint—a halftone film having a uniform dot size over its area and rated by its approximate printing dot size value, as 40%, 50%, etc.

scriber—a pencil-like tool with a shaped point. Used to engrave through the emulsion of a negative in engraving rules or adding other fine printing detail.

script—class of type that resembles handwriting or hand lettering.

scum—film of ink accepted by the nonprinting areas of the plate, generally localized. See tinting.

seasoned—paper which has been brought to proper moisture balance.

secondary color—color formed by mixing two primary colors.

Selectric typewriter—IBM electric typewriter with a type font in the form of a metal ball which skims across the page to bring the proper character into printing position. Type faces are interchangeable on these machines, but they do not have proportional spacing.

self-cover—cover of the same paper as the text; usually printed at the same time.

sensitivity guide—strip of continuous-tone film with numbered gradations or density steps which is stripped into the flat along the gripper edge so that it will print on the plate but will not print on the paper when the job is run. When the plate is exposed, the coating under the scale is overexposed at one end and underexposed at the other. The platemaker can regulate his exposures by exposing so that a predetermined number of the steps on this scale will print solid on the plate.

sensitized—any material coated with an emulsion that is sensitive to light.

sensitizer—light-sensitive solution used in plate coatings.

separation negatives—negatives made through appropriate filters. Each carries densities representing the value of one of the primary colors used in full color printing.

separator finger—metal finger or wire which rides the edge of the paper stack (in the press feeder) to prevent more than one sheet from being pulled into the press at a time.

serifs—the fine cross strokes or feet at the top and bottom of letters.

shading sheet—a transparent sheet with a uniform pattern of dots or other shapes used in the preparation of artwork and camera copy.

shadow—darkest areas of copy; lightest areas of negative.

shadow printer—negative for printing the black plate in duotone work. See also highlight printer.

sheet detector—device which kicks off the impression and ink and in some cases stops the feeder when a sheet fails to feed through the press.

sheet-fed presses—presses which take sheets rather than rolls of paper.

sheet flattening bar—a bar which drops on the sheet to prevent it from buckling when it is positioned by the side guides on the press.

sheet guards—long metal strips which hold down the sheet as it is being carried down the feedboard.

sheet holder tongue—on the Kluge, a device which keeps the sheets from bouncing away from the gauge pins.

sheet line—a line drawn on the goldenrod to show where the sheet will strike in relation to the plate as the paper travels through the press. The area between this line and the gripper edge of the layout is known as the gripper plate margin or the cylinder clamp margin.

sheetwise imposition—imposition which allows the sheet to be printed on one side from one form and on the back from a different form. The same gripper and side guide are used on both runs through the press.

shelf life—period of time before deterioration renders a sensitized material unusable.

shellac—a varnish-like solution which dries very rapidly.

shill—a diagonal mark (/). Also called a virgule.

short ink—ink of a lard-like consistency.

short-scale film—film having an emuslion that records a limited range of tones.

short stop bath—a dilute solution of acetic acid and water used between the developer and fixer in film processing to neutralize the alkali of the developer which otherwise would be transferred to the fixer.

show through—the condition where printing on one side of a sheet can be seen from the other side.

shutter—a mechanical blade which may be opened to admit light to the camera or closed to shut it out. Used to regulate the length of exposure.

side guide—registering device which shoves or pulls the sheet sidewise to the proper registering position just before the impression is made.

side guide bar—the bar to which the side guide is attached. When the press is in operation, this bar moves back and forth toward the center of the feedboard.

side stitch—to flat stitch along the edge of a booklet.

signature—a sheet having a number of pages printed on both sides, usually in multiples of 4.

silhouette halftone—an outline halftone.

silk screen printing—type of printing performed by sqeegeeing paint through a piece of silk stretched tautly over a wooden frame. The nonprinting areas are blocked out by a stencil prepared manually or photographically.

silver bromide—a light-sensitive salt used in photographic emulsions. Generally used for enlarging papers.

silver chloride—a light sensitive salt used in photographic emulsions. Generally used for contact papers.

silver iodine—a light sensitive salt used in photographic emulsions to modify sensitivity of other salts.

silver nitrate—compound used for sensitizing wet-plate emulsions.

silverprint—photographic proof on silver chloride paper. Produces a brown print. Also called Vandyke.

sizing (of paper) treatment of paper to resist penetration of writing or printing ink.

skelton cylinder—series of evenly-spaced disks or segments around which the paper travels as it is caught by the delivery grippers and carried to the delivery stack.

skid—a wooden platform on which paper is stacked in the pressroom or bindery.

skid rollers—on the Multilith, rollers which control the sheet as it is carried down the feedboard.

slip sheet—to place a blank piece of paper on top of each printed sheet as it comes off the press to prevent ink from offsetting.

slitter—see cutting blade.

slow-down mechanism—a device found on some offset presses which slows the sheets down just before they reach the front guides.

slug—a line of type cast in one piece on a letterpress typesetting machine. Also a strip of metal (6 to 12 points thick) used in spacing.

slurred—an impression that is blurred or smudged due to improper pressure.

small caps—letters having the form of capitals and the height of the body of lowercase letters. Used in text to show emphasis.

snake slip—an abrasive stick used for removing spots and unwanted lines from the offset plate.

sodium bicarbonate (baking soda)—mild alkali used to assist plate development.

sodium carbonate—accelerator for photographic developer.

sodium hydroxide (caustic lye)—powerful alkali used to remove old images from press plates. May also be used in washing glazed rollers.

sodium sulfite—preservative for photographic developers (in anhydrous state).

sodium thiosulfate (hypo)—a salt whose water solution dissolves the silver halides. It is used to remove the silver salts remaining in film and paper after development.

soft—low photographic contrast. Halftone dots or fine printing detail with noticeably vignetted edges.

soft ink—a term used to describe the consistency of lithographic inks. A long ink.

solarization—overexposure of film to the point that further increases in exposure actually result in less rather than more density in the negative.

solid matter—lines of type not separated by leads or space.

soybean protein plates—plates made by a process similar to that used for casein plates.

space—a blank piece of type used in letterpress printing to produce white space between words.

specific gravity—ratio of density of a material to water.

speed (emulsion)—degree of sensitivity to light.

Speedball pen point—artist's lettering pen point.

specular light—light waves reflected in only one direction.

spherical aberration—poor central definition caused by the curved surface of the lens.

spiral binding—a patented bookbinding process.

split fountain—the system that permits two colors of ink to be run simultaneously from one fountain.

split gear—on some offset presses, a gear composed of two sections held together by locknuts. Each section is set separately to eliminate gear play.

spot sheet—in letterpress work, a sheet of supercalendered book paper with pieces of tissue paper pasted to it to compensate for low spots in the form; as makeready placed under the drawsheet of a letterpress packing.

spotting out—fine opaquing to remove pinholes or other small transparent defects from a negative.

square finish halftone—a square or oblong halftone.

square serif—name applied to modernistic style of type.

squeegee—a device with a blade of rubber or leather for drying or squeezing off excess water.

stacker—the delivery unit of the folding machine.

staging—protecting certain areas of the plate from etching operations by painting or stopping out with a protective fluid such as varnish or shellac.

stapling—see stitching.

static—electrical charge caused by friction in dry paper stock.

static eliminator—an attachment for printing presses and related equipment designed to remove static electricity from the paper to avoid ink offsetting and trouble with the paper.

stayflat—a nondrying sticky substance similar to the coating on cellulose tape. It is coated on a piece of glass and used to hold film during exposure.

step-and-repeat work—two or more exposures made on the same plate from a single negative by moving it about. Also done with a photo-composing machine.

stereotype—in letterpress work, a metal cut or plate cast from a mold or matrix which has been made up from an original type form or engraving.

stick—a three-sided metal device used by the compositor when he is setting letterpress type by hand.

stitching—fastening the pages of a book together with wire stitches. Staplers use individual staples while the stitcher is fed from a continuous roll of wire.

stock sheet—a standard-size sheet which is kept in stock and cut to smaller sheets as required.

stone—in letterpress work, metal or stone-topped composing table on which type forms are locked for the press. In lithography, a piece of limestone from which the impressions are pulled.

stop-out solution—solution used to make deletions on positive working plates.

straight matter—type composition consisting of line after line set to the same width in the same size and style of type.

stream feeding—a term applied to presses in which the sheets are fed through in a continuous overlapping stream instead of being fed through a sheet at a time.

strip—to fit two or more negatives together on a goldenrod flat. Also to remove a film emulsion from its base.

strip in—same as insert.

stripper fingers—metal fingers on the delivery end of the press that strip the paper from the delivery grippers.

stripping (of press rollers)—refusing to take ink.

stripping film—film having an emulsion which peels from the base after a few minutes in warm water.

subliming—the change of state directly from solid to gaseous.

substance—standard by which business papers (bond, ledger, manifold, duplicator, and mimeo) are weighed. Basis is 500 sheets (commercial standard) or 1,000 sheets (Government standard), 17" x 22."

subtractive color process—process of forming colors by mixing pigments which absorb certain colors and reflect others. See also additive color process.

suckers—vacuum feet used on press for lifting paper and moving it forward.

suction head—a rotating suction wheel found on some offset presses and on some folding machines. See oscillating suctionhead.

suction wheel—on the folder, a revolving wheel which forwards the paper to the conveyor tapes.

sulphate pulp—pulp used in making papers requiring high tear strength.
sulphite pulp—pulp used in making papers requiring long fibers.
sulphur—a substance sometimes used with French chalk to relieve tackiness of the blanket.

summer rollers—hard, composition letterpress rollers used in summer or warm climates.
superimpose—to position negatives or positives on a new flat that is prepared directly over another flat to obtain exact agreement and registration between them. This is frequently done when stripping up complementary or color flats.

surface plates—plates having a flat image on the surface of the metal, as albumin or presensitized plates.
surprint—a print from a second negative superimposed over a print from the first.
suspended pressure—on the folding machine, term used to describe rollers set apart to the exact thickness of the signature being folded.
swing gripper—insertion device used for moving the paper stock into the cylinder grippers after it is stopped by the front guides at the end of the feedboard.
tabular matter—type set in table or statistical form.
tack (ink)—stickiness or pull.
tail brushes—on the offset press, brushes which ride on the tail edge of the sheet to prevent it from bouncing away from the front guides.

tail guides—small metal posts which are set against the back edge of the paper pile.
tail wheels—see driver wheels.
talc (talcum powder)—see magnesium silicate.
tan—to render colloids (such as the albumin plate coating) insoluble by chemical or light action.

Teflon roller covers—transparent, flourocarbon, resinous sleeves, used as covers for the ink rollers on the offset press.
text—main body of a story or publication. Also a class of type, such as Old English.
thermography—creating a raised image by using a powdered resin sprinkled on wet ink and swollen and fused by heat.
thicken—to make dense or viscous in consistency.
thin negative—negative low in photographic density.
throwing in—distributing type.
throw-off lever—lever on platen presses used to throw off the impression when none is desired.
thumbnail sketches—small sketches, quickly drawn to determine the best layout for a job or piece of artwork.

time-temperature method—developing film for a specific time in developer at a specific temperature.
tint—a form of scum appearing uniformly over the press plate. Also a reduction of a solid color.
tint block—a halftone, benday, or solid background, usually in a light color or tint.
tongue—on platen presses, a part of the gage pin which overlaps the edge of the paper.

toning—unwanted tone appearing in the nonimage areas of a plate due to bright lighting of the platemaking area or accidental exposure.
tooth—pitted or rough surface, as tooth in metal plate or drawing paper.
transfer cylinder—(1) insertion device or (2) cylinder used in transferring sheet from one printing unit to another on multicolor presses. See insertion device.
translucency—the ability of certain materials to transmit light without being actually transparent.
transmission—the percentage of light permitted to pass through the negative.
transmission copy—copy, such as slides and transparencies, which is photographed by light transmitted through (rather than reflected from) the copy. See reflection copy.
transparency—a positive copy on glass or film in color or in black-and-white.
transparent proofs—proofs pulled on acetate or cellophane.
trap—ability of an ink to accept and hold succeeding colors when several colors are to be run.
trim line—the line ruled on a layout to denote the limits of the finished page.
trimetal plate—offset press plate consisting of three layers of metal.
trucks—bearers which support the rollers on a platen press.
tumbler grippers—type of grippers found on the impression cylinder of some presses.
turnbuckle—a long metal collar or sleeve with screw threads at the ends for tightening or drawing together two sections of a rod.
turpentine (turps)—semivolatile oil obtained from pine trees and other coniferous trees.

Used as ink solvent and cleaning fluid. It readily attacks rubber.

tusche—a liquid greasy ink used for hand work and correction on lithographic plates.

two-hand clutch—a safety device found on some power paper cutters which requires the operator to use both hands when throwing the cutter in gear to make a cut.

two-up—two identical printing images on a press plate. Usually made by preparing the flat so it can be exposed successively in the two required locations.

two sheet choke—see caliper.

tympan—the drawsheet and packing covering the platen on a platen press. Also a name applied to a type of oiled paper used as impression sheets on cylinder and platen presses.

tympan bail—clamp which holds drawsheet taut against the platen.

type—blocks of metal or wood having raised characters which may be inked and reproduced by pressing against a sheet of paper.

type family—group of type faces which are similar though not exactly alike in design.

type-high—standard height of all type and letterpress cuts. (0.918 inch.)

type series—different sizes of the same type face.

typography—the art of printing with type, involving the style, arrangement, and appearance of the printed page.

Ulano Rubylith—trade name for an acetate sheet having a colored coating which can be peeled off in image areas. Used instead of goldenrod paper in stripping operations.

undercut section (or press cylinders)—a recessed section between the bearers designed to allow for the thickness of the plate or blanket.

undercutting—undermining thin lines and screened areas in platemaking operations or (by fountain solution) on the press.

undertongues—metal sheet rests which extend from below the edge of the feedboard on some offset presses. The front guides are positioned over these tongues.

uppercase—the capital letters of a type face.

U.S.P.—abbreviation for United States Pharmacopoeia, the American standard for purity and strength of many chemicals.

vacuum back—a hinged flat metal plate attached to the back of the camera with a series of concentric vacuum channels which hold the film in place by suction during the exposure.

vacuum pump—pump which supplies suction and blast for separating and feeding sheets into the automatic press.

value—when pertaining to color, the measure of lightness and darkness.

Vandyke—see silverprint.

Varityper—a composing machine having a keyboard similar to that of a typewriter which gives typed matter an appearance similar to printers' type.

varnish—substance used as a vehicle or base in the making of inks. May consist of boiled linseed oil or resins.

vegetable blacks (ink)—pigment made by calcination of grape husks, wine twigs and wood, old wine casks and other similar materials.

vehicle—liquid used to hold pigments together in ink. See varnish.

vertical camera—process camera used in reproduction work. So-called because the bellows extends vertically instead of horizontally.

vibrating rollers—see oscillating rollers.

Videocomp—electronic typesetting machine marketed by RCA.

vignette—type of halftone which has softened "feathered" outlines that blend into the surrounding white space.

viscosity—measure of resistance of fluid to motion; sluggishness.

Visi-type—alphabet printed on acetate. Used for stick-up lettering.

volatile—readily evaporated when exposed to air.

Wale floating nozzle—special blast pipes used on some presses.

walk off—image fades out on press during the run.

walking the plate—twisting the plate on the cylinder to straighten the image on the sheet.

warm colors—colors like red, orange, and yellow which excite the eye.

Warnold process—method of diffusing halftone dots on negatives to give a continuous-tone effect when copying halftone clippings.

wash drawing—a water color drawing which must be reproduced as a halftone.

wash-out—to remove the ink from the image on the plate with lithotine or other solvent.

wash-up attachment—a device for washing the rollers without removing them from the offset press.

Waterhouse stops—blades having round or odd-shaped openings. They may be inserted into the filter slot of the lens and used instead of the lens diaphragm to produce special effects.

watermark—a design impressed into some types of paper by a "dandy roller" during manufacture. Lettering of a watermark should read from left to right when the job is printed; on U.S. rag bond papers, the eagle should face to the left.

water-motion control screw—on the 17" x 22" ATF press, a screw for regulating the length of time the ductor roller is in contact with the fountain roller.

water-on lever—on some ATF presses, a lever for moving the dampener form rollers to or away from the plate.

water stops—small metal fingers with rubber blades. They are attached to the fountain of some offset presses. When placed against the fountain roller, they squeeze off some of the water and thereby reduce the supply reaching the dampeners.

water-to-ink dampening system—dampening system found on some presses in which the water and ink are both fed to the plate from the same set of form rollers.

wave length (of light waves)—the distance from a point on one light wave to a corresponding point on the next wave.

waxing machine—machine used for waxing the back of material to be pasted up for camera copy. Used instead of rubber cement.

web press—a large rotary press that prints from a continuous roll of paper called a web.

wedge gage—a wedge used for determining screen distance and parallelism.

wet plate—a photographic glass plate prepared by flowing with collodion and sensitizing in a silver nitrate bath. Must be exposed and processed while still wet.

wet-strength papers—a paper which retains more than 15 per cent of its dry strength when completely wetted with water.

wetting agent—chemicals used to promote uniform wetting and drying.

whirler—plate coating machine.

winding stock—jogging stock to introduce a blanket of air between the sheets.

winter rollers—soft, composition letterpress rollers suitable for cold climates.

wipe-on plates—plates coated by wiping with a swab of cheesecloth or specially treated cotton saturated with an albumin solution or diazo compound.

wipes—lint-free wiping material in the form of a pad used in platemaking operations.

wire side—the rough side of paper stock which was against the wire mesh in the paper making machine. See felt side.

working areas—the image areas of a lithographic plate.

work and back—see sheetwise imposition.

work and flop or work and tumble—printing the second side of the sheet (using the same press form) by turning the sheets over from gripper to back, using the same side guide for the second run.

work and turn—printing the second side of the sheet, using the same press form, by turning the sheets from left to right, using the same gripper edge.

work order—specification sheet attached to the job.

worm screw—a screw having teeth that thread into the teeth of a gear.

Wratten—trade name for Eastman Kodak filters.

Wrico—mechanical lettering device.

wrong font—a piece of type inserted by error which does not match the style or size of the other letters in a line or a word. Usually marked "wf" by the proofreader.

xenon arc light—light emitted from a xenon gas-filled tube. It is pulsed at 120 times a second but appears as continuous light.

xerographic printing (pronounced zero-GRAF-ic)—process by which the image is transferred by a light-sensitive electrostatic charge on a special base.

Xerox—trade name for equipment used in xerographic printing.

zinc-oxide coating—photoconductive material which becomes light-sensitive when charged with electricity, used as plate coating in some electrostatic platemaking processes.

Zip-A-Tone—a waxed sheet of cellophane on which benday or other shading patterns have been printed. Used as a shading medium for line drawings.

zography—three dimensional printing.

INDEX

A

A.B. Dick Offset Duplicator, Model 350, 340-357
- aquamatic unit, 343
- automatic feeder, 347-351
- blanket cylinder, 343
- chain delivery, 351
- delivery unit, 351
- inking unit, 342
- introduction, 340
- Model, 360
- operator's controls, 340-342
- plate cylinder, 344-347
- press adjustments, 352
- press maintenance, 357
- securing the press, 354
- speed control, 351
- step-by-step operations, 355-357
- wash-up operations, 353

Acidity and Alkalinity Measuring, 139

Acids, Bases and Salts, 138
- measuring acidity and alkalinity, 139

Adjustments, Press, 332-335

Administration, Shop, 479-504

Advancement, Rating, 13

Agitation, 196

Aquamatic unit, 343

Artwork Preparation, 75-94
- color work, 88
- instructions to cameraman, 90
- kinds of copy, 75
- paste-up, 91

ATF 20 and 20A Presses, 358-392
- chief 20A, 380-388
- dampening system, 373
- dampening unit, 388
- delivery unit, 374-380
- feeder control lever, 358-360
- feeder unit, 360-368
  - blower tubes, 363
  - caliper, 364
  - conveyor tapes, 364

ATF 20 and 20A Presses (continued)
  - forwarding rollers, 364
  - front guide adjustments, 366
  - front guides, 365
  - gripper margin, 366
  - loading stock, 360
  - pile height governor, 362
  - separator fingers, 364
  - setting side guide, 367
  - sheet controls, 364
  - sheet detector finger, 365
  - side guides, 367
  - sucker feet, 363
  - tail guides, 361
  - undertongues, 365
- inking system, 374
- introduction, 358
- printing unit, 368-373
  - impression cylinder, 373
  - mounting the blanket, 368
  - mounting plate, 369-371
  - positioning image, 372
  - quick-change plate clamps, 371
- speed control, 358
- starting and stopping the press, 358
- summary of operations, 389-392

Automated Cameras, 126-134
- darkroom equipment, 126
- darkroom sinks, 127
- densitometers, 127-129
- film cabinet, 131
- film dryers, 131-134
- film processors, 127
- photoelectric densitometers, 129
- safelights, 130
- timers, 134
- visual densitometers, 129

Automatic Counter, 331

Automatic Exposure Computers, 193

Automatic Feeder for A.B. Dick Offset Duplicator, Model 350, 347-351
- buckle control knob, 350
- caliper, 350
- forwarding rollers, 350

- Automatic Feeder for A.B. Dick Offset Duplicator, Model 350 (continued)
  - paper levelers, 349
  - paper weight, 349
  - pile height control, 349
  - setting feeder, 348
  - sheet detector fingers, 350
  - sucker feet, 350
- Automatic Feeder for Multilith 1250, 323-331
  - adjusting caliper, 328
  - adjusting suction and blast, 326
  - cam band adjustment, 330
  - control lever and sheet detector, 331
  - front guides, 329
  - loading feeder, 325
  - pile height control, 327
  - pullout rollers, 328
  - separator fingers, 327
  - sheet controls, 329
- Automatic Feeder for Offset Press, 293-301
  - caliper, 297
  - conveyor tapes, 298
  - flap shaft, 296
  - forwarding rollers, 297
  - front guides, 299
  - insertion devices, 299
  - loading the feeder, 295
  - pile height governor, 296
  - separator fingers, 296
  - sheet cotrols, 298
  - sheet detector finger, 300
  - sheet flattening bar, 300
  - slide guides, 299
  - slowdown mechanism, 300
  - suction and blast adjustments, 296
- Autmatic Feeder Presses, 466
- Automatic Joggers, 302
- Autopositive and Duplicating Films, 155
- Autoscreen Film, 210
  - making exposure, 210

B

- Bases, Photographic, 141
- Bases, Salts, and Acids, 138
- Basic Exposures, 182-190
- Basic Flash Exposure, 186
- Basic Main Exposure, 184-186
- Basic Size and Basis Weight of Paper, 397-400
  - bulk and caliper, 400
  - equivalent weight, 398-400
- Bellows, 116
- Bindery Equipment, 422-443
- Bindery Safety, 422
- Binding and Padding, 437-439
- Binding, Spiral and Plastic, 440-442
- Blanket Care of Multilith 1250, 337
- Blanket Cylinders, 322, 343
- Blast, 382
- Blast and Suction Adjustments, 296
- Bleed Illustration, 87
- Blower Tubes, 363
- Boards and Control Cards, 491
- Book Papers, 401
- Bookwork Impositions, 230
- Borders and Ornamentation, 31-34
- Bristols and Cards, 403
- Buckle Control Knob, 350
- Bulk and Caliper of Paper, 400
- Business Papers, 401

C

- Caliper, 397, 350, 364
- Caliper Adjustment, 328
- Caliper and Bulk of Paper, 400
- Cam Band Adjustment, 330
- Camera Components, 114-124
  - bellows, 116
  - camera lamps, 121-123
  - copyboard, 114
  - focusing controls, 118-121
  - ground glass, 116
  - halftone screen holders, 118
  - lensboard, 114
  - vacuum back, 117
  - Camera-Direct Plates, 251-253
- Camera Lamps, 121-123, 265
- Cameraman's Daily Dozen, 167
- Camera, Process, 99-101
- Camera-Processor, 3M, 261
- Cameras, Automated, 126-134
- Cameras, Vertical Process, 124-126
- Carbonless Papers, 402
- Cards and Bristols, 403
- Caring for Paper, 405-407
  - static, 407
- Chain Delivery, 332, 351
- Character Counting, 38-40
- Chemistry of Photographic Emulsions, 139-141
- Chemistry and Photography, 138
- Chief 20A, 380-388
  - blast, 382
  - delivery unit, 384
  - feeder unit, 380-382
  - front guide, 382
  - inking unit, 384-38

- Chief 20A (continued)
  - plate and blanket cylinders, 382-384
  - side guide, 382
  - stock thickness adjustment, 384
  - suction, 382
- Classes of Type, 27-31
- Classification Categories, 484-486
  - confidential, 485
  - secret, 485
  - special markings, 485
  - top secret, 485
- Classified Material, 308
- Classified Material Destruction, 489
- Classified Material Handling, 481
  - preparation and marking, 485
- Classified Matter, 168
- Coating, 396
- Cold Type Composition, 36-74, 500
- Collating, 437
- Color, 412-416
  - color harmony, 414
  - letterpress inks, 414-416
  - mixing inks for color, 412-414
  - subtractive color, 412
- Colored Copy, 165-167
- Color Harmony, 414
- Color Reproduction Negatives, 165
- Color Sensitivity, 142
- Color Separation, 202-206
  - combination work and tints, 204
  - masking, 204, 206
  - proofs, 204
  - reverse lettering, 206
  - splicing negatives, 205
  - surprinting, 205
- Color Stripping, 242-244
- Color Work, 88-90
  - color blocks and tint areas, 88
  - halftone color separation, 90
  - overlapping colors, 89
- Combination Copy, 87
- Combination Work and Tints, 204
- Composition, Cold Type, 36-74
- Composition, Display, 59-62
- Computer, Kodak Halftone Negative, 190-193
- Computers, Automatic Exposure, 193
- Computer Use, 477
- Confidential, 485
- Contact Printers, 135
- Contact Screen, 177
- Contact Screen Care, 208
- Contact Screen, Magenta, 178-182
- Contemporary Type, 28-31
- Control Cards and Boards, 491
- Conveyor Tapes, 298, 364
- Copyboard, 115, 264
- Copy Fitting, 36-40
  - character counting, 38-40
  - scaling wheel, 36-38
- Copy Kinds, 75-88
  - combination copy, 87
  - line work, 75-81
  - special effects, 87
  - tone copy, 81-87
- Copyrighted Materials, 490
- Correction Making, 74
- Corrections (Negative) and Stripping, 217-245
- Counter, Automatic, 331
- Counterfeiting and Fraud, 490
- Covers, 403
- Cropping Halftones, 222
- Cross Carriers, 431
- Custodians, 486
- Custody, 486-488
  - access and dissemination, 487
  - accountability, 487
  - combinations, 486
  - custodians, 486
  - eligibility standards, 487
  - emergency planning, 487
  - numerical evaluation system, 486
  - security clearance, 487
  - storage, 486
- Cuts, letterpress, 472-475
- Cutting Tools, 219
- Cutters, Paper, 423-428
- Cylinder, Blanket, 322
- Cylinder Grippers, Impression, 301
- Cylinder, Presses, 4, 288-293

D

- Daily Dozen, Cameraman's, 167
- Dampening (Repelex) System, 317-321
- Dampening Systems, 282-288, 373
  - fountain solution, 284
  - paper covers, 285-287
  - roller covers, 285
  - water feed ratchet, 284
  - water and ink balance, 285
  - water stops, 284
  - water-to-ink roller dampening systems, 287
- Dampening Unit, 388
- Darkroom Equipment, 126
- Darkroom Safety, 137
- Darkroom Sinks, 127
- Deep Etch Plates, 254
  - multimetal plates, 254

Definitions of Security Terms, 481-484
Deflectors, 431
Delivery, Chain, 332
Delivery Units, 301, 351, 374-380, 384
  automatic joggers, 302
  delivery platform, 302
Densitometers, 127-129
  photoelectric, 129
  visual, 129
Destruction of Classified Material, 489
  methods of destruction, 489
  records, 489
Developer, 149
Developer Strength, 194-196
Developing by Inspection, 196-202
  dropping out whites, 202
  elliptical (chain dot) gray contact screens, 199
  gray contact screens, 198
  respi contact screens, 199
  round dot screens, 199
  screened positives, 198
  special-effect screens, 199-202
Developing Time, 196
Development, 194
Difficulties, ink, 417-421
Direct Image Masters, 40
Direct-Image Plates, 253
Display Composition, 59-62
  hand lettering, 59
  mechanical lettering, 60-62
  pastedown lettering, 62
  photolettering machines, 62
  pressure-transfer lettering, 62
Distributing Type, 455
Double Printing, 237-239
  attaining register, 237
  film register marks, 237
  pin register, 238
  printing on film, 238
Drill, paper, 442
Driography, 253
Dry Offset Presses, 276
Duplicating and Auto Positive Films, 155
Duplicator, A.B. Dick Offset, Model 350, 340-357

E

Early Plates, 246
Electrostatic Plates, 248-250
Emulsion Chemistry, Photographic, 139-141
Emulsions, Film, 142-148
Engraving, Negative, 222
Enlisted Rating Structure, 13
Envelopes, 404
Equipment, Bindery, 422-443
Equipment Maintenance Duties, 494
Equipment and Materials, Stripping, 217-222
Equipment, Photographic, 95-137
Equipment, Photographic Printing, 134-137
Estimating Job, 497-500
Evaluation System, Numerical, 486
Exposure Computers, Automatic, 193
Exposures, Basic, 182-190
  basic flash exposure, 186
  basic main exposure, 184-186
  highlight (bump) exposure, 187
  tone correction, 188-190

F

Face and Grain, Paper, 397
Feeder, Automatic, 293-301, 323-331
Feeder Control Lever, 358-360
Feeder, Kluge, 466-472
Feeder Presses, Automatic, 466
Feeder Unit, 360-368, 380-382
Film, 141
Film, Autoscreen, 210
Film Cabinet, 131
Film Dryers, 131-134
Film Emulsions, 142-148
  characteristic curves, 147
  color sensitivity, 142
  contrast, 143
  kinds of film, 144
  speed, 145
  types of exposures, 146
Film Processing, 148-154
Film Processors, 127
Film Register Marks, 237
Films, Duplicating and Auto Positive, 155
Films, Training, 21
Filters, 112-114, 266
Finishing, 396
Fire Protection, 308
Fitting Copy, 36-40
Flap Shaft, 296
Flare, 112
Flash Exposure, Basic, 186
Flatbed Presses, 4
Flat Stripping, 223-229
Focal Length, 105
Focusing Controls, 118-121
Folders, Types of 428
Folding Impositions, 432
Folding Machines, 428-432
  cross carriers, 431
  deflectors, 431

Folding Machines, (continued)
  feeder units, 428
  folding impositions, 432
  folding unit, 430
  register table, 429
  scoring, 431
  stacker, 432
  types of folders, 428
Folding Machines, Table Top, 432-436
Fold Plates, 433
Fold and Trim Marks, 235
Form Locking, 456-458
Forwarding Rollers, 297, 350, 364
Fountain Keep, 279
Fountain Solution, 284
Frames, Printing, 134
Fraud and Counterfeiting, 490
Front Guides, 299, 329, 365, 382

G

Gang Layouts, 229-237
  bookwork impositions, 230
  fold and trim marks, 235
  imposition charts, 230
  preparing the flat, 233-235
  sheetwise impositions, 231
  splicing negatives together, 236
  stripping bleeding images, 235
  work and tumble impositions, 233
  work and turn impositions, 232
Gathering, 436
Glass Halftone Screen, 172-177
  exposure time, 175
  multiple exposures, 173-175
  screen angle, 176
Glass Plates, 141
  Glazing and Stripping, 416
Goldenrod, 217-219
Gothic Type, 28
Grain and Face, Paper, 397
Gripper Margins, 224, 366
Grippers, Impression Cylinder, 301
Ground Glass, 116

H

Halftone Color Separation, 90
Halftones, Cropping, 222
Halftone Negative, 171-216
Halftone Negative Computer, Kodak, 190-193
Halftone Negative Difficulties, Table 8-1, 213-216
Halftone Positives, 207
Halftone Rescreening, 208
Halftone Screen, Glass, 172-177
Halftone Screen Holders, 118
Hand Lettering, 59
Handling Classified Material, 481
Handpunch, 443
Handset Composition, 500
Harmony, Color, 414
Headliner, 62-71
Heavy Stock Running, 339
Highlight (Bump) Exposure, 187

I

IBM Magnetic Tape Selectric Typewriter, 57
IBM Proportional Spacing Machine, 49-55
  Model D, 54
IBM Selectric Typewriter, 55-59
Image Formation, 101-103
Image Masters, Direct, 40
Imposition Charts, 230
Impositions, 230-233
  bookwork, 230
  sheetwise, 231
  work and tumble, 233
  work and turn, 232
Impression Cylinder, 293
Impression Cylinder Grippers, 301
Imprest Fund, 495
Ink, 407-410
  additives, 408
  body, 409
  drying of inks, 409
  mixing inks, 410
  pigments, 408
  properties of, 409
  tack, 409
  vehicles, 407
Ink Feed Ratchet, 280-282
Inking System, 278-282, 321, 374
  fountain keys, 279
  ink feed ratchet, 280-282
  ink roller covers, 282
  raising and lowering form rollers, 278
Inking Unit, 342, 384-388
Ink and Paper, 393-421
Ink Roller Care, 416
  glazing and stripping, 416
Ink Difficulties, 417-421
  teflon roller covers, 416
Ink Roller Covers, 282
Insets, 87
Inspection Developing, 196-202
Intaglio Printing, 2
Intensification, 154
Inventory Report, Shipboard, 480

Inverse Squares Law, 106
Investigations, Personnel Security, 488
Italic Type, 28

J

Job Estimating, 497-500
    for offset, 499
Job Planning, 22-35
    dummy making, 24
    layout, 23
    specification sheets, 25
Joggers, Automatic, 302
Justifying Lines, 450
Justowriter, 58

K

Kinds of Copy, 75-88
Kinds of Paper, 400-404
Kinds of presses, 274-278, 458-466
    dry offset presses, 275
    multicolor presses, 276
    Navy presses, 277
    numbering machines, 466
    open platen presses, 459
    parts and accessories, 461
    sheet-fed presses, 274-276
    size and types of press, 274
    tympan, 459
    web presses, 274
Kluge Feeder, 466-472
    blast adjustment, 470
    delivery table, 471
    final adjustment of air release valve, 470
    inking system, 471
    Kluge model D, 471
    loading magazine, 470
    makeready operations, 467
    operation of, 466
    putting a form on press, 467
    setting air release valve, 469
    setting delivery arm, 469
    setting magazine, 469
    setting sucker feet on feed arm, 468
    sheet holder tongue, 468
Kluge Model D, 471
Kodak Halftone Negative Computer, 190-193
Kodak Photo Resist Plates, 253

L

Layout, 23
Layouts, Gang, 229-237
Layout of Shop, 496
Legibility Factors, 34
Lens, 101-112
    flare, 112
    F-numbers, 107
    focal length, 105
    focusing, 103-105
    image formation, 101-103
    inverse squares law, 106
    lens aberrations, 110-112
    lens care, 112
    lens diaphragm, 107
    lens speed, 107-109
    shutters, 109
Lensboard, 114
Lens Diaphragm, 107
Lettering, Reverse, 239
Letterpress Cuts, 472-475
    duplicate plates, 472-475
Letterpress inks, 414-416
Letterpress Printing, 2, 444-478
Letterpress vs. Offset, 444
Letterpress Work Estimates, 500-502
    distribution and cleanup operations, 502
    handset composition, 500
    imposition and lockup, 501
    makeready, 501
    makeup, 501
    press time, 502
    proofing and proofreading, 501
Light, 95-98
    comparison of sound waves and light waves, 96
    how we see color, 96
    reflection, 97
Light Table, 219
Line Negative, 158-170
    copy, 158
    procedures, 159-163
        checking copy, 159
        exposing film, 161
        film processing, 161
        focusing camera, 159
        inspection, 162
        loading film, 160
        mounting copy, 159
        setting camera lamps and lens, 159
    standardization, 158
Line Work, 75-81
    draftsman's tools, 80
    illustration board, 76
    preparing line drawings, 76
    production shortcuts, 79
    ruling forms, 79
    techniques, 77-79
Lithographer, Navy, 1-21

Lithographic Printing, 3-7
    bindery operations, 7
    copy to film, 7
    going to press, 7
    making plate, 7
    planning and production, 6
Lithography, offset, 3-5, 7
Locking the Form, 456-458
Lockups, Multipage, 458

M

Machine, Photocomposing, 241
Machines, Folding, 428-432
Machines, Photo typesetting, 477
Machines, Typesetting, 475-477
Magazine, 266
Magenta Contact Screen, 178-182
    density range of copy, 182
    lens opening, 179
    making exposure, 179
    screen position, 179
    screen range, 180-182
Magnetic Tape Selectric Typewriter, IBM, 57
Maintenance of A.B. Dick Offset Duplicator, Model 350, 357
Maintenance Duties, Equipment, 494
Maintenance of Multilith 1250, 335-338
    blanket care, 337
    cleaning dampener rollers, 337
    cleaning ink rollers and fountain, 336
    insurance, 335
    vacuum pump maintenance, 337
Making Corrections, 74
Making Paper, 394-397
Making Plates, 246-273
Masking, 204, 206
Materials Copyrighted, 490
Materials and Equipment, Stripping, 217-222
Materials, Photographic, 138-157
Mechanical Lettering, 60-62
Metalphoto, 271
    handling and storage, 271
Mixing Inks, 410
Mounting the Plate, 322
Multicolor Presses, 276
Multilith 1250, 317-339
    maintenance, 335-338
    operator's controls, 317
    press specifications, 317
    step-by-step operations, 338
Multimetal Plates, 254
Multipage Lockups, 458
Multiple Exposures, 266

N

National Agency Check, 488
Naval Publications and Printing Service, 479-481
    shipboard inventory report, 480
NAVEDTRA 10052, 18
Navy Lithographer, 1-21
    duties, 12
Navy Presses, 277
Navy's Small Offset Presses, 317-321
    Dampening (Repelex) System, 317
    inking system, 321
    multilith 1250, 317

NEC's, 13
Negative Computer, Kodak Halftone, 190-193
Negative Corrections and Stripping, 217-245
Negative Engraving, 222
    ruling lines, 223
Negative, Halftone, 171-216
Negative, Line, 158-170
Negatives for Color Reproduction, 165
Negatives, Paper, 141
Negative Splicing, 236
Numbering Machines, 466
Numerical Evaluation System, 486

O

Offset Lithography, 3-5, 7
    basic principle, 3
    cylinder presses, 4
    flatbed presses, 4
    in Navy, 7
    photography, 5
    rotary presses, 5
    stone age, 3

Offset Presses, 5, 274-316
    safety habits, 306
Offset vs. Letterpress, 444
On-the-Job Training, 502
Open Platen Presses, 459
Optical Scanners, 478
Ornamentation and Borders, 31-34
    borders and rules, 31
    legibility, 32
    length of line, 32
    letterspacing, 34
    spacing, 33
    type style and size, 32

Overlapping Colors, 89

P

- Packing and Wrapping, 443
- Padding and Binding, 437-439
- Paper, 393-407
  - caring for, 405-407
  - kinds of, 400-404
- Paper Basic Size and Basis Weight, 397-400
- Paper Care, 405-407
- Paper Covers, 285-287
- Paper Cutters, 423-428
  - caring for, 427
  - operating, 423-425
  - trimming paper, 425-427
- Paper Drill, 442
- Paper Grain and Face, 397
- Paper and Ink, 393-421
- Paper, Kinds of, 400-404
  - book papers, 401
  - bristols and cards, 403
  - business papers, 401
  - carbonless papers, 402
  - covers, 403
  - miscellaneous papers, 403
- Paper Levelers, 349
- Papermaking, 394-397
  - additives, 395
  - coating, 396
  - finishing, 396
  - pulp, 394
- Paper Negatives, 141
- Paper, Photographic, 155
- Paper, Recycled, 404
- Paper Weight, 349
- Pastedown Lettering, 62
- Paste-Up, 91-93
  - makeup with coldtype composition, 92
  - waxing machine, 93
- Personnel Security Investigations, 488
  - background investigation, 488
  - national agency check, 488
- Photocomposing Machine, 241
- Photoelectric Scanners, 210
- Photographic Bases, 141
  - film, 141
  - glass plates, 141
  - paper negatives, 141
- Photographic Emulsion Chemistry, 139-141
- Photographic Equipment, 95-137
- Photographic Materials, 138-157
  - safety precautions, 155
- Photographic Papers, 155
- Photographic Printing Equipment, 134-137
  - contact printers, 135
  - miscellaneous darkroom equipment, 136
  - print drying, 136
  - printing frames, 134
  - projection printers, 135
  - vacuum printers, 135
  - variations in equipment, 136
- Photography Basic Principle, 98
- Photography and Chemistry, 138
- Photolettering Machines, 62
- Photo Resist Plates, Kodak, 253
- Phototypesetting Machines, 477
- Pigments, Ink, 408
- Pile Height Control, 327, 349
- Pile Height Governors, 296, 362
- Pin Register, 238
- Plastic and Spiral Binding, 440-442
- Plate Cylinder, 344-347
- Platemaking, 246-273
- Plate Mounting, 322
  - raising or lowering image, 323
  - straightening plate on cylinder, 322
- Plates, Deep Etch, 254
- Plates, Early, 246
- Plates, Relief, 254-257
- Plates, Surface, 247-254
- Plate Types, 247
- Polaroid Prints, Screened, 210
- Polishing, 273
- Positive Copies, 164
- Positives, Halftone, 207
- Postal Printing, 490
- Practical Factors Record, 17
- Presensitized Plates, 247
- Press Adjustments, 332-335, 352
  - adjusting blanket-to-plate pressure, 334
  - adjusting ink form rollers, 333
  - dampener form roller adjustments, 334
  - impression cylinder adjustments, 334
  - leveling the cylinder, 335
- Press Cylinders, 288-293
  - attaching blanket to cylinder, 289
  - attaching clamp bars, 290
  - impression cylinder, 293
  - mounting the plate, 290
  - positioning image on paper, 291-293
- Presses, ATF 20 and 20A, 358-392
- Presses, Automatic Feeder, 466
- Presses, Kinds of, 274-278, 458-466
- Presses, Offset, 5, 274-316
- Press Operation, 302-306
  - before starting press, 303
  - centering image sidewise, 305
  - clean-up operations, 306

Press Operation (continued)
  examination during the run, 305
  final preparation, 305
  making corrections, 304
  mounting the plate, 304
  positioning image on sheet, 305
  printing trial sheet, 304
  raising or lowering image, 305
  setting the feeder, 304
  straightening image, 305
Pressure-Transfer Lettering, 62
Print Drying, 136
Printers, 135
  contact, 135
  projection, 135
  vacuum, 135
Printing, 1-3
  intaglio printing, 2
  letterpress printing, 2
  lithographic printing, 3
  reproduction processes, 3
Printing, Double, 237-239
Printing Frames, 134
Printing, Letterpress, 444-478
Printing Unit, 368-373
Printing, Unlawful, 489
Process Camera, 99-101
Processing, 272
  development and fixing, 272
  intensifying, 272
  polishing, 273
  sealing, 273
  stain removal, 273
Processing the Film, 148-154
  agitation of the developer, 152
  deterioration, 152
  developer, 149
  developing time, 151
  development by inspection, 151
  drying, 154
  fixing solution, 153
  preparing the developer, 150
  short-stop bath, 153
  temperature, 151
  washing, 153
Processing Presensitized Plates, 257-271
  3M Camera-Processor, 261
  camera lamps, 265
  copyboard, 264
  daily maintenance operations, 269
  developing, 259-261
  filling processor tanks, 268
  filters, 266
  focusing, 265
  focusing thick originals, 265
  general maintenance, 270
Processing Presensitized Plates (continued)
  inspecting the plate, 268
  magazine, 266
  making deletions, 268
  making the exposure, 266
  mounting new roll in machine, 267
  multiple exposures, 266
  operating controls, 262-264
  periodic maintenance, 269
  printing the plate, 257-259
  processing a positive-working plate, 261
  processing unit, 267
  punching the plate, 268
  securing the processor, 270
  subtractive plates, 261
Projection Printers, 135
Proofing, 452
Proofreading, 71-74
Proofs, 204, 244
Proofs, Transparent, 455
Proportional Spacing Machine, IBM, 49-55
Publications and Printing Service, Naval, 479-481
Punching, 443
  hand punch, 443
Pullout Rollers, 328
Pulp, 394

Q

Quals Manual, 17

R

Rate Training Manuals, 19-21
Rating Advancement, 13
  qualifying for, 14
Rating Structure, Enlisted, 13
Record of Practical Factors, 17
Records and Reports, 491
  control cards and boards, 491
Recycled Paper, 404
  envelopes, 404
Reducing, 154
Reference Library, 504
Reference Materials, 93
Reflection, 97
Register Table, 429
Relief Plates, 254-257
Repeat and Step Work, 240
Repelex Dampening System, 317-321
Reproduction, Negatives for Color, 165
Requests, Work, 491-494
Requisitioning Supplies, 495
  imprest fund, 495
  repair parts, 495

Rescreener, 208
Rescreening Halftones, 208
  contact screen care, 208
  rescreener, 208
  warnold process, 208
Reverse Lettering, 206, 239
Roller Care, Ink, 416
Roller Covers, 285
Roller Covers, Teflon, 416
Roman Type, 27
Rotary Presses, 5
Running Heavy Stock, 339

S

Safelights, 130
Safety in Bindery, 422
Safety in Darkroom, 137
Safety Training, 503
Safety with Offset Presses, 306
  cleanliness, 306
  guards, 307
  in press operation, 306
  press controls, 307
  washing operations, 307
Salts, Acids, and Bases, 138
Scaling Wheel, 36-38
Scanners, Optical, 478
Scanners, Photoelectric, 210
Scoring, 431
Screened Polaroid Prints, 210
Screens, 177, 198-202
  contact, 177
  elliptical (chain dot) gray contact, 199
  gray contact, 198
  respi contact, 199
  round dot, 199
  special-effect, 199-202
Script Type, 28
Sealing, 273
Secret, 485
Security Areas, 484
  controlled, 484
  exclusive, 484
  limited, 484
Security Clearance, 487
Security Investigations, Personnel, 488
Security Principles, 481
Security Program Purpose, 481-484
  security principles, 481
  security terms definitions, 481-484
Security Terms Definitions, 481-484
Selecting Type Style, 26
Selectric Typewriter, IBM, 55-59
Sensitivity Guides, 163
Separation, Color, 202-206
Separator Fingers, 296, 327, 364
Sheet Controls, 298, 329, 364
Sheet Detector Fingers, 300, 350, 365
Sheet-Feed Presses, 274-276
Sheet Flattening Bar, 300
Sheet Holder Tongue, 468
Sheetwise Impositions, 231
Shipboard Inventory Report, 480
Shop Administration, 479-504
  instructions and notices, 479
  rules and regulations, 479
  shop layout, 496
Shop Layout, 496
Short-Stop Bath, 153
Shutters, 109
Side Guides, 367, 382
Spacing Machine, IBM Proportional, 49-55
Specification Sheets, 25
Speed Control, 351, 358
Spiral and plastic Binding, 440-442
Splicing Negatives, 205, 236
Stacker, 432
Stacker Controls, 433-436
Stain Removal, 273
Standardization, Line Negative, 158
Stapling and Wire Stitching, 439-442
  plastic and spiral binding, 440-442
Starting and Stopping Buttons, 2[illegible]3
Static, 407
Step and Repeat Work, 240
Strength of Developer, 194-196
Stripping Bleeding Images, 235
Stripping for Color, 242-244
  stripping for positive working plates, 243
Stripping Equipment and Materials, 217-222
  corrections, 221
  cropping halftones, 222
  cutting tools, 219
  Goldenrod, 217-219
  light table, 219
  tape, 219
  using cutting tools, 220
Stripping a Feat, 223-229
  gripper margins, 224
  making simple layout, 225
  planning the layout, 223
  position the negative, 225
  preparing flats for larger presses, 228
  reference lines, 225
  ruling the layout, 224
  stripping for narrow widths, 225-228
Stripping and Glazing, 416
Stripping and Negative Corrections, 217-245

- Subtractive Color, 412
- Subtractive Plates, 261
- Sucker Feet, 350, 363
- Suction, 382
- Suction and Blast Adjustments, 296
- Supplies, Requisitioning, 495
- Supply Duties, 494
- Surface Plates, 247-254
  - camera-direct plates, 251-253
  - direct-image plates, 253
  - driography, 253
  - electrostatic plates, 248-250
  - Kodak Photo Resist Plates, 253
  - presensitized plates, 247
  - transfer plates, 250
  - wipe-on plates, 247
- Surprinting, 205

T

- Tympan, 459
- Type Cases, 446-449
- Type Classes, 27-31
  - contemporary, 28-31
  - gothic, 28
  - italic, 28
  - roman, 27
  - script, 28
  - text, 28
- Type Distribution, 455
- Typesetting, 444-455
  - correcting errors, 452
  - emptying stick, 450
  - justifying lines, 450
  - makeup, 451
  - proofing, 452
  - pulling proofs on direct image plates, 454
  - reproduction proofs, 453
  - rules and borders, 451
  - setting type, 449
  - spacing materials, 450
  - transparent proofs, 455
  - type cases, 446-449
  - typing the form, 452

- Typesetting Machines, 475-477
- Types of Plates, 247
- Types of Presses, 306
- Type Style Selecting, 26
  - resemblances and differences, 26
  - type faces, 26

- Typewriter, IBM Magnetic Tape Selectric, 57
- Typewriter, IBM Selectric, 55-59
- Table Top Folding Machines, 432-436
  - feeder setup, 432
  - first roller pressure adjustment, 433
  - fold plates, 433
  - removing transportation axles, 436
  - scoring, slitting, perforating, 436
  - stacker controls, 433-436
- Tack, Ink, 409
- Tail Guides, 361
- Teflon Roller Covers, 416
- Text Type, 28
- Time For Developing, 196
- Timers, 134
- Tint Areas, 240
- Tints, 206
- Tone Copy, 81-87
  - clippings, 86
  - cripping, 84
  - mounted photographs, 84
  - photographs, 82
  - retouching, 82-84
  - scaling, 85
  - tone drawings, 86
  - transparencies, 87
- Tone Correction, 188-190
- Top Secret, 485
- Training New Men, 502-504
  - on-the-job training, 502
  - reference library, 504
  - safety training, 503
  - work rotation, 502
- Training Films, 21
- Transfer Plates, 250
- Transparent Proofs, 455

U

- Undertongues, 365
- Unlawful Printing, 489
  - counterfeiting and fraud, 490

V

- Vacuum Back, 117
- Vacuum Printers, 135
- Vacuum Pump Maintenance, 337
- Varityper, 40-49
- Vehicles, Ink, 407
- Vertical Process Cameras, 124-126

W

- Warnold Process, 208
- Water Feed Ratchet, 284
- Water and Ink Balance, 285
- Water Stops, 284

Waxing Machine, 93
Web Presses, 274
Wipe-On Plates, 247
Wire Stitching and Stapling, 439-442
Work Estimates, Letterpress, 500-502
Work Requests, 491-494
Work Rotation, 502
Work and Tumble Impositions, 233
Work and Turn Impositions, 232
Wrapping and Packing, 443

LITHOGRAPHER 3 & 2

NAVEDTRA 10452-C

This course was prepared by the Naval Education and Training Program Development Center, Pensacola, Florida, for the Chief of Naval Education and Training

---

This assignment booklet (including answer sheets) is a part of a training package combining the Rate Training Manual and Nonresident Career Course.

Each assignment is made up of a series of items based on assignment readings in the textbook. At the beginning of each assignment is listed the specific text material that should be studied. The answer sheets to be completed are enclosed as a separate package.

WHAT IS THE COURSE OBJECTIVE

While completing this nonresident career course, the student will demonstrate his understanding of course materials by correctly answering items on the following: The Lithographer rating, the enlisted rating structure, and requirements for advancement; job planning; cold type composition; art preparation; photographic equipment and materials; line and halftone negatives; negative corrections and stripping; platemaking; the operation of various printing presses and duplicators; paper and ink; bindery equipment; letterpress printing; and shop administration.

TO GET THE MOST OUT OF THIS COURSE

If there is an errata sheet included with this course, make all indicated changes and corrections in the assignment booklet and textbook.

Study those pages of the textbook listed for each assignment. Pay particular attention to the illustrations as they give a lot of information in a small space. Making your own drawings will help you understand some of the explanations you read.

When you have finished the required readings for an assignment, answer the items in the assignment booklet. Read each item carefully. Consult your textbook to help you select the best answer. You may discuss difficult points in the course with your Division Officer or shipmates. However, the answer that you select must be your own. Indicate your answer directly on the answer sheet by erasing the appropriate block.

You may find that some of the text content has become obsolete since the text was written. However, since the course is based on the textbook, in answering items be sure to select the best answer from the information in the textbook. The obsolete matter in the textbook will be brought up to date when the text is revised.

Use only the designated answer sheet for each assignment. Follow the directions found on the answer sheet to determine the proper procedures for completing it.

To complete this course successfully, you must meet the following standard: If you are on active duty, the average of the grades earned on all assignments must be at least 3.2. If you are not on active duty, the average of the grades earned on all assignments in each creditable unit of the course must be at least 3.2. (See the Naval Reserve Retirement box on the next page for the retirement points evaluated for this course.)

WHO WILL ADMINISTER YOUR COURSE

Your nonresident career course may be administered by your Command, or in the case of small commands your course may be administered by the Naval Education and Training Program Development Center. Consult your Division Officer and follow the instructions stated below for local administration if your course is administered by your Command. Follow the instructions for Naval Education and Training Program Development Center administration if your course will be administered by the Center.

WHEN THE COURSE IS ADMINISTERED BY YOUR COMMAND

Adhere as closely as possible to a schedule of completing at least one assignment per month. Unnecessary delay in completing the course may prevent you from becoming fully qualified to take the regularly scheduled fleet-wide competitive examination for advancement.

Before completing the answer sheet, fill in all blanks at the top of the answer sheet.

Submit your completed assignments to the officer administering your course. He will discuss with you any of the questions that you do not understand. When the entire course has been completed and a satisfactory grade attained, a notation to this effect should be made by your local Command in your service record. By this means you will be given credit for your work.

The Naval Education and Training Program

Development Center does not issue Letters of Satisfactory completion to enrollees who have their courses administered by their own Command.

- WHEN THE COURSE IS ADMINISTERED BY THE NAVAL EDUCATION AND TRAINING PROGRAM DEVELOPMENT CENTER

Adhere as closely as possible to a schedule of completing at least one assignment per month; however, retain all the answer sheets until you have completed the course, then mail them to the Center. The Center will verify and record your scores. Remember that unnecessary delay in completing the course may, if you are a Reservist, prevent you from earning enough retirement credits to complete a year of Satisfactory Federal Service. Reservists may submit their answer sheets upon completion of a creditable unit.

Answer sheets are not returned by the Center, but you will receive formal notification of your final grade for the course (or creditable unit of the course) by issuance of a Letter of Satisfactory Completion. Keep the Center informed of your present address.

Fill in all blanks on the answer sheet. Unless you supply all the information required it will be impossible to give you credit for your work.

The textbook for this course should NOT be returned to the Naval Education and Training Program Development Center.

WHEN PREPARING FOR YOUR ADVANCEMENT EXAMINATION

Your examination for advancement will be based on the latest edition of the Manual of Qualifications for Advancement (NAVPERS 18068). It is possible that the qualifications for your rating may have changed since this nonresident career course and its accompanying textbook were printed.

The study suggestions that are in this nonresident career course, in the Rate Training Manual, and in the current edition of Bibliography for Advancement Study (NAVEDTRA 10052) are intended to help you locate study materials on which the examination will be based.

Be sure to refer to the latest editions of NAVPERS 18068 and NAVEDTRA 10052 when preparing for your examination.

NAVAL RESERVE RETIREMENT

This course is evaluated at 28 Naval Reserve retirement points. These points are creditable to personnel eligible to receive them under current directives governing retirement of Naval Reserve personnel. NOTE: Naval Reserve Retirement credit will not be given for this course if the student has previously received retirement credit for any Lithographer 3 & 2 ECC or NRCC. Points will be credited in units as follows:

Unit 1: 12 points upon satisfactory completion of Assignments 1 through 6.
Unit 2: 12 points upon satisfactory completion of Assignments 7 through 12.
Unit 3: 4 points upon satisfactory completion of Assignments 13 through 14.

Naval nonresident career courses may include a variety of items -- multiple-choice, true-false, matching, etc. The items are not grouped by type; regardless of type, they are presented in the same general sequence as the textbook material upon which they are based. This presentation is designed to preserve continuity of thought, permitting step-by-step development of ideas. Some courses use many types of items, others only a few. The student can readily identify the type of each item (and the action required of him) through inspection of the samples given below.

MULTIPLE-CHOICE ITEMS

Each item contains several alternatives, one of which provides the best answer to the item. Select the best alternative and erase the appropriate box on the answer sheet.

SAMPLE

s-1. The first person to be appointed Secretary of Defense under the National Security Act of 1947 was

1. George Marshall
2. James Forrestal
3. Chester Nimitz
4. William Halsey

The erasure of a "C" is indicated in this way on the answer sheet:

	1 T	2 F	3	4	
s-1	■	C	■	■	

TRUE-FALSE ITEMS

Determine if the statement is true or false. If any part of the statement is false the statement is to be considered false. Erase the appropriate box on the answer sheet as indicated below.

SAMPLE

s-2. Any naval officer is authorized to correspond officially with a bureau of the Navy Department without his commanding officer's endorsement.

The erasure of a "C" is indicated in this way on the answer sheet:

	1 T	2 F	3	4	
s-2	■	C	■	■	

MATCHING ITEMS

Each set of items consists of two columns, each listing words, phrases or sentences. The task is to select the item in column B which is the best match for the item in column A that is being considered. Specific instructions are given with each set of items. Select the numbers identifying the answers and erase the appropriate boxes on the answer sheet.

SAMPLE

In items s-3 through s-6, match the name of the shipboard officer in column A by selecting from column B the name of the department in which the officer functions.

A. Officers

s-3. Damage Control Assistant

s-4. CIC Officer

s-5. Assistant for Disbursing

s-6. Communications Officer

B. Departments

1. Operations Department
2. Engineering Department
3. Supply Department

The erasure of a "C" is indicated in this way on the answer sheet:

	1 T	2 F	3	4	
s-3	■	C	■	■	
s-4	C	■	■	■	
s-5	■	■	C	■	
s-6	C	■	■	■	

NOTICE: If, on erasing, a page number appears, review text (starting on that page) and erase again until "C" appears. No points are earned for the item unless the "C" is uncovered. Follow directions exactly as on answer sheet.

While working on a nonresident career course, a student may refer freely to open-book texts and references. He may seek advice and instruction from others on problems arising in the course, but the solutions submitted must be the result of the student's own work and decisions. The student is prohibited from referring to or copying the solutions of others, or giving completed solutions to anyone else taking the same course. Noncompliance can result in suspension from the course by the administering activity and disciplinary action by the Chief of Naval Personnel.

Assignment 1

The Navy Lithographer; Job Planning

Textbook NAVEDTRA 10452-C: Pages 1-35

In this course you will demonstrate that learning has taken place by correctly answering training items. The mere physical act of indicating a choice on an answer sheet is not in itself important; it is the mental achievement, in whatever form it may take, prior to the physical act that is important and toward which the NRCC learning objectives are directed. The selection of the correct choice for a course training item indicates that you have fulfilled, at least in part, the stated objective(s).

The accomplishment of certain objectives, for example, a physical act such as drafting a memo, cannot readily be determined by means of objective type course items; however, you can demonstrate by means of answers to training items that you have acquired the requisite knowledge to perform the physical act. The accomplishment of certain other learning objectives, for example, the mental acts of comparing, recognizing, evaluating, choosing, selecting, etc., may be readily demonstrated in a course by indicating the correct answers to training items.

The comprehensive objective for this course has already been given. It states the purpose of the course in terms of what you will be able to do as you complete the course.

The detailed objectives in each assignment state what you should accomplish as you progress through the course. They may appear singly or in clusters of closely related objectives, as appropriate; they are followed by items which will enable you to indicate your accomplishment.

All objectives in this course are learning objectives and items are teaching items. They point out important things, they assist in learning, and they should enable you to do a better job for the Navy.

The nonresident course is only one part of the total Navy training program; by its very nature it can take you only part of the way to a training goal. Practical experience, schools, selected reading, and the desire to accomplish are also necessary to round out a fully meaningful training program.

Learning Objective: Determine the development of printing; the methods, procedures, requirements, and operations as related to offset lithography; and the development of lithography in the Navy.

1-1. Unlike letterpress, intaglio printing is done from
   1. chemically treated plates
   2. raised letters
   3. etched plates
   4. photographs

1-2. What is another name for lithography?
   1. Planography
   2. Inking
   3. Oil painting
   4. Cartography

1-3. Alois Senefelder is important in the history of printing because he invented
   1. movable type
   2. the offset press
   3. intaglio
   4. stone lithography

1-4. What condition makes it possible to print from flat letters on a flat plate?
   1. Oil and water will not mix
   2. Paper will not absorb grease
   3. Ink and water will mix
   4. Ink will adhere to a stone

1-5. Limestone was used in early lithography mainly because of its
   1. weight and strength
   2. porosity and smoothness
   3. low cost and availability
   4. ease of handling and smoothness

1-6. Early lithography failed to compete commercially with the letterpress process mainly because
1. letterpress had more of a tradition of use
2. lithography was too hard to learn
3. the text was backward on a lithographic plate, whereas it was forward on a letterpress plate
4. the letterpress process was faster than the lithographic process

1-7. What finally enabled lithography to compete commercially with letterpress?
1. Introduction of zinc and aluminum plates that could absorb grease and water and were light and pliable
2. Rapid increase in the number of artisans
3. Invention of the flatbed press
4. Dissatisfaction with the letterpress process

1-8. The offset press differs from the direct lithographic press in that the former
1. can reproduce photographs
2. has fewer cylinders
3. uses a plate whose image reads forward
4. uses a plate whose image is reversed

1-9. The process of printing on an offset press from a lithographic plate made with the aid of a camera is most often called
1. offset printing
2. photo-offset printing
3. zincography
4. planography

1-10. What is the purpose of cutting windows in the yellow-orange paper used in stripping?
1. To indicate that the exposed area requires retouching
2. To expose areas which have defects
3. To allow ink to be applied only to the exposed area
4. To expose only the area that is to be printed on the plate

1-11. As a Navy Lithographer, which of the following operations must you be able to perform?

1. Copy preparation and negative stripping
2. Camera work and platemaking
3. Bookbinding and press work
4. All of the above

1-12. Which of the following difficulties was experienced by Lithographers in the early days of offset printing when offset presses were installed aboard ships?
1. Difficulties in maintaining correct ink and water balance
2. Variations in light-sensitive coating on the plates
3. Non-standardization of chemical formulas and techniques
4. All of the above

Learning Objective: Recognize the types of duty and the study materials, publications, and procedures needed to advance in the Lithographer rating.

1-13. Generally, the type of duty to which an LI is assigned depends on his
1. pay grade
2. experience
3. time in grade
4. leadership ability

1-14. A general rating is one which reflects qualifications in
1. civilian skills identified with a wartime Navy
2. civilain skills identified with a peacetime Navy
3. broad occupational fields of related duties and functions
4. subdivisions or specialities within broad occupational fields

1-15. The rating structure for naval personnel in the Lithographer rating at pay grades E-4 and E-5 provides for
1. two service ratings only
2. one general rating only
3. one general rating and two service ratings
4. two general ratings and one service rating

1-16. What source of information may you consult to determine changes that may occur in the Navy enlisted advancement system?
1. BUPERS Notice 1418
2. NAVTRA 10052 (Series)
3. NAVPERS 15105 (Series)
4. NAVPERS 18068 (Series)

1-17. Assume that you are an LI3 on active duty and working for advancement to LI2. You have the required time in grade and recommendation for advancement by your commanding officer. You also have successfully completed the necessary training courses and practical factors for LI2. In order to qualify for advancement, you are also required to

1. pass Navy-wide advancement examinations
2. pass locally prepared advancement tests
3. attend a class A school
4. satisfactorily participate in a drill unit

1-18. Which system is used by the Navy to determine the men who may be advanced?

1. Personnel testing system
2. Seniority system
3. Final multiple system
4. Merit rating system

● In items 1-19 and 1-20, assume that you are an LI2.

1-19. Lithographer striker Robinson asks you what type of material he should study in preparing for the written examinations for advancement to LI3. What Navy procedures concerning written examinations should you explain to Robinson?

1. He may take the Navy-side occupational examination and then the E-5 separate military/leadership examination
2. He must pass the E-5 separate military/leadership examination before taking the occupational examination
3. He must pass the E-4 separate military/leadership examination before taking the occupational examination
4. He may take the Navy-wide occupational examination and then the E-4 separate military/leadership examination

1-20. You should tell him also that the examinations contain questions relating to

1. occupational knowledge factors only
2. military and occupational knowledge factors
3. both knowledge and practical factors of an occupational nature
4. practical and knowledge factors of both a military and an occupational nature

1-21. It is important to you that the division officer's copy of NAVPERS 1414/1 be included in your service record when you are transferred because the form

1. is used for your semiannual performance evaluation
2. indicates the military and occupational practical factors that you have completed
3. is used to list all the training courses you have satisfactorily completed
4. is used for all of the above information

1-22. The minimum occupational and military requirements that an LI3 must meet to advance to LI2 are given in the latest edition of

1. Bibliography of Advancement Study, NAVTRA 10052 (Series)
2. Manual of Qualifications for Advancement, NAVPERS 18068(Series)
3. Basic Military Requirements, NAVTRA 10054(Series)
4. List of Training Manuals and Correspondence Courses, NAVTRA 10061(Series)

1-23. Before being eligible to take a Navy-wide advancement examination for a rate, the Lithographer must complete those training courses that are marked with an asterisk in

1. Bibliography for Advancement Study, NAVTRA 10052 (Series)
2. Manual of Navy Enlisted Classifications, NAVPERS 15105 (Series)
3. List of Training Manuals and Correspondence Courses, NAVTRA 10061 (Series)
4. Manual of Qualifications for Advancement, NAVPERS 18068 (Series)

1-24. Each mandatory training course must be completed by passing the appropriate correspondence (nonresident career) course that is based on it.

1-25. The first thing that you should do in starting your study of a Navy training course is to

1. read the chapter headings
2. outline the entire course
3. familiarize yourself with the entire course
4. prepare a list of questions to be answered as study progresses

1-26. Which of the following sources provide information necessary in the performance of your duties?
1. Navy Instructions
2. Reference publications
3. Navy Notices
4. All of the above

1-27. A camera-ready job is one that consists of
1. preparing original art work
2. printing a job which requires no copy preparation
3. selecting type styles
4. preparing a layout

1-28. What term is applied to the planning and various operations performed for a new job?
1. Copy preparations
2. Camera-ready
3. Dummy preparation
4. Original composition

1-29. What is the important consideration in determining the physical form of a printing job?
1. The size of type to be used
2. The kind of paper stock available
3. The purpose of the job
4. The availability of reproduction proofs

1-30. Which of the following factors are considered when you determine the dimensions of a job?
1. The binding operations required
2. The size of the paper stock on hand
3. The size of the press
4. All of the above

1-31. If a large press must be used to print a small job, the job is usually printed two or more up to save paper and to
1. cut bindery operations
2. make use of strip-ins
3. reduce press time
4. facilitate saddle stitching

1-32. What is the bindery term for a sheet of paper with a number of pages printed on it?
1. A rough layout
2. A signature
3. A specification
4. A press layout

1-33. What kind of stitching is generally used to bind a book if each of its pages is printed on a separate sheet?
1. Side stitching
2. Saddle stitching
3. Loop stitching
4. Backstitching

1-34. What is the first step in a copy preparation job?
1. Preparing original artwork
2. Selecting type styles
3. Making a dummy
4. Preparing the layout

1-35. When planning a job, the Petty Officer in charge of the print shop may make a layout to
1. serve as a guide for the personnel in the shop
2. show the arrangement of illustrations and type
3. provide the originator with a visual idea of the job
4. do all of the above

1-36. A book of blank pages ruled to scale to show exactly where type and illustrations are to be located in final printing is called a
1. signature
2. dummy
3. first proof
4. rough layout

1-37. What is one of the simplest methods of indicating type areas on the dummy?
1. Paste in type proofs
2. Rule in heavy and light lines
3. Mark a square or rectangle on the page
4. Type the areas on the page

1-38. Instead of preparing a dummy, the Petty Officer in charge of a smaller print shop generally prepares a
1. press layout sheet
2. job order
3. press preparation form
4. copy specification form

1-39. To determine the color of ink to use on a new job, you should consult the
1. Petty Officer in charge
2. person who requested the job
3. specification sheet
4. dummy

Learning Objective: Describe considerations that should be made in selecting type faces and distinguish between the classes of type.

1-40. What is your first concern in selecting type?
1. Boldness
2. Dignity
3. Clarity
4. Strength

1-41. Large, bold type faces are effective in attracting attention and provide legibility that invites reading.

1-42. Which system does the printer use when measuring type sizes?
1. Point system
2. Decimal system
3. Metric system
4. Octal system

1-43. Approximately what fraction of an inch is 18-point Bodoni type?
1. 1/8 inch
2. 1/4 inch
3. 1/2 inch
4. 3/4 inch

1-44. Faces which are exactly alike in design and differ only in size are called
1. tribes
2. type series
3. groups
4. families

1-45. Faces which are similar but unlike in design are classified as being of the same
1. tribe
2. series
3. group
4. family

1-46. Which of the following type faces presents the heaviest appearance?
1. Bodoni
2. Bodoni Book
3. Bodoni Bold
4. Ultra-Bodoni

1-47. In which of the six classes of type is most reading matter printed?
1. Roman
2. Gothic
3. Script
4. Contemporary

1-48. The principal difference between oldstyle and modern roman types is that oldstyle has
1. straight serifs
2. rounded serifs
3. thin hairlines
4. heavier shadings

1-49. Which of the following types most closely resembles gothic?
1. Oldstyle roman
2. Kaufmann script
3. Sans serif bold
4. Modern roman

1-50. Script type face differs from cursive type face in that the letters of script type are combined by the use of connecting links or
1. serifs
2. swashes
3. kerns
4. curls

1-51. Most type styles have matching slant letters called
1. uppercase
2. lowercase
3. script
4. italics

In items 1-53 through 1-56, select from column B the type group that is customarily used for the purpose in column A.

A. Purpose

1-52. To print envelopes and letterheads

1-53. To emphasize a word in text material

1-54. To add an air of elegance and charm to display work

1-55. To print religious programs

B. Group

1. Gothic
2. Script
3. Text
4. Italics

1-56. Which group of type contains Lydian, Onyx, Studio, and Stymie type faces?
1. Contemporary
2. Script
3. Gothic
4. Text

1-57. What characteristic is common to the sans serif style and the square serif style of contemporary faces?
1. Geometric proportions
2. Square serifs
3. Absence of serifs
4. Presence of serifs

Learning Objective: Recognize the principles of using ornamentation, borders, and rules.

1-58. What name is given letters that are used at the beginning of a paragraph to dress up the page?
1. Swash letters
2. Cursive letters
3. Small caps
4. Initial letters

1-59. What principle is generally followed when you use an initial letter to begin a page or a paragraph?
1. The entire sentence is capitalized
2. The rest of the sentence is printed in bold face
3. The rest of the word is capitalized
4. The remainder of the word is italicized

1-60. When you select ornaments for a print job, what principle should you follow?
1. Apply the so-called scotch rule
2. Use ornaments that correspond with the type style
3. Select ornaments for decoration only
4 Abundantly decorate the work with ornaments

1-61. The so-called scotch rule consists of
1. 2 thin lines
2. 2 heavy lines
3. only 1 heavy line
4. 1 thin line and 1 heavy line

1-62. With which type face would you be more apt to use a scotch rule border?
1. Gothic
2. Bodoni
3. Sans serif
4. Futura

1-63. Rules are lines within a printed page used for the purpose of
1. guiding the reader's eye
2. separating sections of a page
3. serving as writing lines
4. doing any of the above

1-64. Which line weight is generally used to divide the sections of a form?
1. Medium rule
2. Hairline rule
3. Heavy rule
4. Scotch rule

Learning Objective: Determine the factors that affect the legibility of print.

1-65. Which of the following factors should you consider in attaining legibility?
1. Length of line
2. Style of letter
3. Size of type
4. All of the above

1-66. What size of type is considered the easiest to read?
1. 2 to 5-point
2. 5 to 7-point
3. 8 to 14-point
4. 20 to 25-point

1-67. You should use ____________(A)____________ column widths for 8-point type and
2 to 3 inch; 2 to 5 inch
____________(B)____________ column widths for 10-point type.
2 to 3 inch; 2 to 5 inch
1. (A) 2 to 3 inch; (B) 2 to 5 inch
2. (A) and (B) 2 to 3 inch
3. (A) and (B) 2 to 5 inch
4. (A) 2 to 5 inch; (B) 2 to 3 inch

1-68. Many newspaper columns measure 2 inches in line length. What is the line length of such a column in (A) picas and (B) points?
1. (A) 10 picas, and (B) 100 points
2. (A) 12 picas, and (B) 144 points
3. (A) 10 picas, and (B) 120 points
4. (A) 12 picas, and (B) 120 points

1-69. Lines forming a column 2 inches wide require less leading than lines forming a column 8 inches wide.

1-70. Letterspacing is the technique of adding space between the words of large display faces.

1-71. Why are condensed faces more practical than expanded faces for display work?

1. Because there is no appreciable loss of legibility
2. Because condensed faces are more readable
3. Because more characters can be placed in a line
4. Because of both 1 and 3 above

1-72. How do paragraphs and indentions affect legibility?

1. Both decrease it
2. Both increase it
3. Indentions increase it, but paragraphing decreases it
4. Paragraphing increases it, but indentions decrease

Assignment 2

Cold Type Composition

Textbook NAVEDTRA 10452-C: Pages 36-74

Learning Objective: Recognize methods of producing cold type composition and determine steps in copy fitting cold type composition.

2-1. Cold type composition includes copy produced by all of the following methods except

1. Justowriter machine
2. Headliner machine
3. Linotype metal slug
4. VariTyper

2-2. What aspect of typed copy remains fixed when the copy is reduced?

1. Height of the letters
2. Proportions of the copy
3. Width of the copy
4. Width of the letters

2-3. You use the "scaling" plan to find typing dimensions. How deep would a column of reduced typing be if copy 12 inches deep and 4 inches wide were to be reduced to a column 2 inches wide?

1. 3 in.
2. 4 in.
3. 6 in.
4. 8 in.

A. Move long pointer to 25
B. Set short pointer to 25
C. Set long pointer to 30
D. Set long pointer to 50
E. Move long pointer to 30
F. Set short pointer to 50

List 2A

2-4. Which steps from list 2A should you perform, in sequence, on the scaling wheel when you reduce art 30 picas wide and 50 picas deep to 25 picas wide?

1. C, F, A
2. D, B, E
3. C, F, E
4. A, F, C

2-5. Copy fitting involves selecting a piece of copy of representative size and type face and counting the number of characters in

1. 4 lines and multiplying by 10
2. 5 lines and dividing by 5
3. 6 lines and adding 50
4. one-half the copy

Learning Objective: Determine methods of preparing direct image plates.

2-6. Which factor determines the quality of the copies printed from direct image masters?

1. The type of material from which they are made
2. The type of press on which they are used
3. The size of the direct image master
4. The method of preparing the direct image master

2-7. For the preparation of direct image masters an electrical typewriter is an advantage over the mechanical typewriter because with the electrical typewriter the

1. left and right margins are easier to set
2. spacing between characters is more uniform
3. typing pressures are better controlled
4. spacing between words is more even

2-8. When you prepare direct image masters, you should handle them with care and keep the composing equipment clean and in good operating order because the masters

1. are susceptible to grease
2. can be easily scratched by fingernails or metal
3. are expensive and may be damaged by wrinkling
4. are very fragile

2-9. The "gripper margin" of a plate is the area located between the
1. face of the copy and the left edge of the plate
2. right margin of the copy and the right edge of the plate
3. last line of the copy and the bottom of the plate
4. top of the master and the line showing where typing can begin

2-10. Which step should you perform first when preparing a direct-image plate consisting of typing and a drawing?
1. Filling in the large black areas with a brush
2. Drawing
3. Typing
4. Ruling with a grease ball-point pen

Learning Objective: Recognize the characteristics of the VariTyper machine and procedures of operating it.

2-11. The VariTyper provides differential spacing. What is meant by differential spacing?
1. The automatic spacing between words to make each line the same length
2. The automatic spacing between each line of typed copy
3. The automatic adjustment of spaces between each letter and each word
4. The automatic spacing of each letter to its width

2-12. The DSJ model VariTyper differs from the DS model VariTyper in that the DSJ model
1. uses interchangeable type fonts
2. varies the space between words so that each line is the same length
3. provides proportional spacing
4. uses interchangeable type fonts and provides proportional spacing

2-13. When you insert paper into the VariTyper you disengage the line spacing mechanism by
1. turning the feed roll knob out
2. moving the feed roll release lever forward
3. pushing the feed roll knob in
4. moving the feed roll release lever to the rear

2-14. How do you raise the anvil to insert a type font in the VariTyper?
1. By lifting the anvil knob
2. By moving the keyboard's type change lever forward
3. By lowering the anvil knob
4. By moving the keyboard's type change lever to the rear

2-15. The letter at the end of the type font identification number indicates the
1. type font style
2. size of the type
3. amount of spacing between lines
4. amount of spacing allowed for each character

2-16. Assume that you have a type font identified by the number 680-12A and you want 2-point spacing between each line. At what dial number would you align the point indicator of the line spacing controls?
1. 12
2. 13
3. 14
4. 15

2-17. The suppression control lever lessens the force of the hammer on all of the following characters except
1. !
2. j
3. l
4. I

2-18. If you allow three increments for each space between words, how many increments would you use on the DS VariTyper for the line: When may I start the test?
1. 71
2. 73
3. 75
4. 77

2-19. Assume that you have set the left margin on the VariTyper. As you check the setting of the left margin you find that the carriage does not return to the exact same position. How do you correct this discrepancy?
1. By turning the margin stop adjuster knob
2. By resetting the margin stop
3. By realigning the dial pointer with the vertical line on the dial
4. By doing any of the above

2-20. Refer to your textbook and figure 3-8. Which key, when depressed, locks the VariTyper font in position to type several successive characters of the bottom row?
1. C
2. D
3. E
4. F

2-21. How many times must you type the copy on the DSJ VariTyper if you are to justify the right margin?
1. One
2. Two
3. Three
4. Four

2-22. Where is the ribbon shield located on the VariTyper?
1. Back of the anvil
2. In front of the anvil
3. Between the two guides on the left side of the font
4. Between the two guides on the right side of the font

Learning Objective: Determine characteristics of the IBM Proportional Spacing Machine and procedures of operating it.

2-23. One advantage of the IBM Proportional Spacing Machine over the regular typewriter for preparing photo-offset copy is that the IBM machine
1. is more portable
2. has interchangeable type faces
3. has letters that resemble conventional type faces
4. provides automatic justification

2-24. Unlike the IBM Proportional Spacing Machine, the typewriter
1. can type regular carbon copies
2. provides equal space for each letter
3. has conventional type faces
4. has a keyboard

2-25. How many notches forward from "A" should you move the multiple copy control lever to allow the IBM Proportional Spacing Machine to type 9 carbons?
1. One
2. Two
3. Four
4. Five

2-26. You may insert one-unit spacing between the words of a line of type printed on the Proportional Spacing Machine by first pressing the
1. two-unit space bar and then pressing the three-unit space bar
2. three-unit space bar and backspacing the two-unit space bar
3. two-unit space bar and pressing the word expander button
4. two-unit space bar and backspacing one unit

2-27. You have a heading that contains 52 units and the line of type is 144 units. To center the heading, how many units must you space before typing the first letter of the heading?
1. 26
2. 46
3. 72
4. 98

2-28. The release of which of the following mechanisms will automatically return the platenroller of the IBM Proportional Spacing Machine to its regular line spacing?
1. Line position reset lever
2. Variable line spacer
3. Paper release lever
4. Line space lever

2-29. How can you determine that the Proportional Spacing Machine requires a new spool of ribbon?
1. The carriage fails to move when the keys are pressed
2. Red appears in the ribbon supply indicator window
3. The carriage fails to move when the spacing bars are pressed
4. Red appears through the on-off switch window

2-30. Which of the following brushes should you use to clean the type on your IBM machine?
1. Wire brush
2. Camel's-hair brush
3. Bristle brush
4. Any of the above

2-31. You may find it necessary to clean the keys of your machine with a cloth moistened with
1. any cleaning solvent
2. blanket wash
3. light oil
4. mild detergent

2-32. What change is incorporated into the Model D IBM Proportional Spacing Machine?
1. Repeating action of 7 keys
2. Provision for typing blind
3. Indication of space remaining at the bottom of the page
4. All of the above changes

Learning Objective: Determine the characteristics of the IBM Selectric equipment and the Justowriter.

2-33. The IBM Selectric Typewriter differs from the conventional electric typewriter in that the former has a ball that moves across the page to bring the character into printing position.

2-34. You correct a mistake when typing with the IBM Magnetic Tape Selectric Typewriter by
1. erasing the error and finding your typing position with the pointer
2. backspacing and retyping the character
3. tabulating and typing the correction in the margin
4. covering the mistake with white correction tape and retyping the character

2-35. Which IBM machine uses proportional spacing?
1. Magnetic Tape Selectric Composer
2. Selectric Typewriter
3. Magnetic Tape Selectric Typewriter
4. All of the above

2-36. How many times must you type the copy when you use the Justowriter?
1. One
2. Two
3. Three
4. Four

2-37. When you are typing the rough copy on the Justowriter and make a mistake, you correct the error by
1. backspacing and retyping the character
2. covering the error with white correction tape and retyping the character
3. erasing the error, backspacing, and retyping the correct character
4. pressing the "line delete" key and retyping the line

Learning Objective: Recognize methods and techniques of preparing display composition.

2-38. All of the following type is classified as display type except
1. 14 point Bodoni Book
2. 18 point Ultra-Bodoni Italic
3. 10 point Bodoni Book
4. 24 point Caslon Old Style

2-39. Which method of preparing display composition is more likely to present a friendly, informal tone to the finished work?
1. Leroy lettering
2. Visi-Type pastedown lettering
3. Alphagraph photolettering
4. Hand lettering

2-40. If you have a ragged edge while lettering with a speedball pen, you can best correct the mistake by
1. erasing it with an ink eraser
2. touching it out with chinese white
3. lettering over it with a larger point
4. removing the blot with alcohol

2-41. A good pen to use for making thick square letters that have geometric sharpness is the Speedball
1. A5
2. B0
3. A1
4. B2

2-42. Which pen is a part of a mechanical aid for lettering display composition?
1. Leroy
2. Speedball
3. Crow quill
4. Gillot's 303

2-43. Pressure-transfer letters differ from Art Type and Visi-Type letters in that pressure-transfer letters
1. are pasted to the artwork
2. are printed on acetate sheets
3. always have to be sprayed with a plastic fixative
4. can be removed with a pencil eraser if necessary

Learning Objective: Determine techniques of operating the Headliner Photocomposing Machine.

2-44. You should use the slots at the edge of the TypeMaster disk of the Headliner to regulate the
1. type size
2. proportional spacing
3. upper and lower case characters
4. right and left margins

2-45. By which method is the paper carried through the developing tank?
1. By belt-driven sprocket wheels
2. By cable-driven sprocket wheels
3. By chain-driven sprocket wheels
4. By electric motor-driven sprocket wheels

2-46. Which of the following actions indicate that you have properly inserted the paper in the Headliner?
1. The paper feeds from left to right as you turn the paper feed knob clockwise
2. The paper feeds from right to left as you turn the paper feed knob counterclockwise
3. The paper feeds from left to right as you turn the paper feed knob counterclockwise
4. The paper feeds from right to left as you turn the paper feed knob clockwise

2-47. After you have inserted the TypeMaster and set the lighthouse, wordspacing, and letterspacing controls, you discover that the characters are printing incompletely. What correction should you make?
1. Open the lighthouse setting
2. Readjust the wordspacing and letterspacing dials
3. Reposition the TypeMaster on the Headliner
4. Close the lighthouse setting

2-48. For a 14-point TypeMaster you should set the wordspacing dial by rapidly turning the dial to an 8-point setting and then gradually moving it up to the 14-point setting.

2-49. What is the purpose of the Exposureminder?
1. To control the length of time the lighthouse lamp is on
2. To assist in maintaining the proper temperature of the developing solution
3. To automatically compensate for the relationship of the exposure time to the strength of the developing solution
4. To assist in maintaining a specific amount of current flow through the lighthouse lamp

2-50. At what point in the operation of the Headliner is the tape cut from the roll?
1. After exposure but before development
2. After fixing but before washing
3. After development but before fixing
4. After washing and being forced from the Headliner

2-51. The Headliner machine automatically shuts down while you are printing the third character of a four letter word. By which method, if any, may you complete the word?
1. By no method
2. By feeding the paper manually with the paper feed knob
3. By depressing the line limit switch
4. By raising the cut-off lever

In items 2-52 through 2-55, select from column B the most probable cause for the Headliner problem in column A.

A. Problem	B. Cause
2-52. Printing and developing produces blank paper	1. Dirt in the TypeMaster slot
2-53. Characters overlap on the printed paper	2. Burned out exposure bulb
2-54. Grayish or indistinct characters	3. Overexposure
2-55. Characters lack sharpness	4. Underexposure

2-56. Which problem may be corrected by feeding more paper into the storage chamber?
1. Paper does not come out of the developing tank and the developing light remains on
2. Paper fails to feed into developing tank when the cut-off lever is raised
3. Cut-off lever can not be raised
4. The machine shuts off

Learning Objective: Recognize the proofreaders symbols and procedures used when proofreading and correcting copy.

A. Mans odds for survival in polar areas could be
B. greatly increased as a result of 2 recent inventions
C. sponsored by the coast guard.
D. The inventions include a light weather-Resistant tent,
E. and a blanket which, when folded, will fit in the palm
F. of the hand Both are designed to conserve body warmth.
G. Light, portable and easily assembled, the tent is
H. made of fabric which is windproof and water proof.
I. Yet it is porous enough to permit the escape of body
J. moisture while retaining the occupants body heat.
K. The blanket is made of light, aluminized plastic film
L. which possesses unusual toughness and durability. This
M. type film is presently used in space operations.
N. Although the blanket measures 56 by 84 in, it
O. be can folded into a small, rectangular package suitable
P. for easy handling.

Figure 2A.-An article to be proofread.

- Information for items 2-57 through 2-68: Figure 2A is an example of an article as it came off a typewriter. The capital letters preceding each line are used as a reference to identify the lines. Proofread the article, using the appropriate marks given in figure 3-45 and the information in chapter 3 of your textbook. Then answer items 2-57 through 2-68.

2-57. Which marks did you use to indicate that the number in line B and the unit of measurement in line N are to be spelled out?
1. sp
2. two and inches
3. copy out
4. ld >

- For items 2-58 through 2-61 use the following alternatives:
1. $\overset{\prime}{\vee}$
2. /
3. ⊙
4. ≡

2-58. Which of the symbols did you use in line C?

2-59. What symbol is used in line D?

2-60. What symbol did you enter in lines A and J to indicate the possessive case?

2-61. Which of the symbols did you use to correct the punctuation of line F?

2-62. In line E you made marks to remove the commas preceding and following "when folded". To retain these commas you write
1. rectify
2. disregard
3. insert
4. stet

2-63. Which symbol indicates that punctuation was omitted in line G?
1. ;
2. =/
3. $\overset{\wedge}{,}$
4. $\overset{\prime\prime}{\vee}$

- For items 2-64 through 2-67 use the following alternatives:
1. no ¶
2. $\overset{\smile}{\frown}$
3. ∼
4. ℓ

2-64. Which proofreader's mark did you use to indicate that line I continues the subject begun in line G?

2-65. What symbol did your insert at line O to indicate the transposition of words?

2-66. What symbol did you show in line H to indicate that two words are actually only one word?

2-67. Which mark did you use to eliminate the duplicated word in line P?

2-68. What mark did you enter to indicate that line M is not properly aligned?
1. ⊐
2. ⊏
3. =
4. ⊐⊏

2-69. Proofreader's corrections on reproduction copy should be made in the margin with a
1. fountain pen
2. light green pencil
3. ball point pen
4. light blue pencil

2-70. Which of the following methods is recommended for making most corrections to cold type composition?
1. Cutting in the correction
2. Erasing and retyping the correction
3. Applying white opaque correction fluid and retyping
4. Using correction tape to cover the mistake and retyping

Assignment 3

Artwork Preparation; Photographic Equipment

Textbook NAVEDTRA 10452-C: Pages 75-99

Learning Objective: Select and identify the types of art materials and the procedures used in the preparation of all artwork that will be photographed before printing.

In items 3-1 through 3-4, select from column B the artwork classification which includes the artwork in column A.

	A. Artwork	B. Classification
3-1.	A photograph with applied lettering	1. Line copy
3-2.	An oil painting	2. Tone copy
3-3.	A pen and ink drawing	3. Combination copy
3-4.	A black and white photograph	

3-5. Shading can be added to line copy by applying
1. crosshatching
2. patterned acetate
3. both 1 and 2 above
4. solid blocks of color

3-6. Which of the following ink colors produces satisfactory results for the reproduction of a line drawing?
1. Gray
2. Yellow
3. Red
4. Light blue

3-7. Original drawings are usually prepared twice or one and one-half times larger than the final reproduction.

3-8. What should you do to indicate that the final size of a piece of artwork is to be larger than the original artwork?
1. Mark the new width in picas in the margin of the copy
2. Mark "Not S/S" in the margin of the copy
3. Make sure to see the artist personally
4. Do the artwork over in the correct size

A. Zip-a-tone
B. Craft-tint paper
C. Visi-type
D. Colored paper
E. Paratone
F. Ross board
G. Illustration board
H. Scratchboard

List 3A

3-9. Line drawings should be drawn or mounted on which material in list 3A?
1. A
2. B
3. F
4. G

3-10. Which material in list 3A gives a shaded effect when its pebbled surface is drawn upon?
1. A
2. C
3. F
4. H

3-11. Which material in list 3A requires the use of an acid developing solution?
1. A
2. B
3. G
4. H

3-12. Which of the materials in list 3A are waxed on one side so that they may be affixed to the drawing paper?
1. C, E, and G
2. B, D, and F
3. F, G, and H
4. A, C, and E

3-13. Which of the materials in list 3A must be coated with ink before highlights are scratched into its surface?
1. B
2. D
3. F
4. H

3-14. Clippings and photographs intended for use as copy can be improved, if need be, by using india ink, chinese white, black and white watercolor, or photographic filters.

3-15. A pantograph is a mechanical tracing instrument which can be used for
1. producing a crosshatch effect in line drawings
2. determining right angles
3. spraying a fine mist of paint or ink onto a photograph or drawing
4. making line drawings from photographs

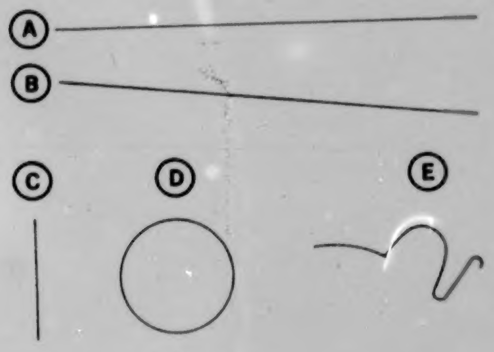


Figure 3A. - Types of draftsman's lines

3-16. Which of the following tools is best suited for use as a guide in producing A in figure 3A?
1. French curve
2. Dividers
3. T-square
4. Compass

3-17. Which of the following tools is best suited for use as a guide in producing C in figure 3A?
1. Dividers
2. Triangle
3. French curve
4. Compass

3-18. Which part of figure 3A was produced by using a french curve as a guide?
1. A
2. C
3. D
4. E

3-19. Which of the following erasers is used for cleaning smudges and dirt from drawing paper?
1. Pencil eraser
2. Art gum eraser
3. Kneaded gum eraser
4. Both 2 and 3 above

3-20. Light blue pencils are often used for initial sketches mainly because lines that are drawn in this color
1. photograph as black
2. are soft and easy to work with
3. do not show up in a photograph
4. are easy to erase

3-21. All of the following procedures apply to the correct use of the ruling pen except to
1. vary the line width by setting the thumbscrew
2. dip only the point into the ink to refill the pen
3. hold the pen upright with a slight tilt in the direction you are drawing
4. keep the outside of the point wiped clean to prevent the pen from running

3-22. In photographing tone work, which of the following methods is used to break the copy into dots?
1. The artist attaches a fine, patterned acetate sheet over the copy
2. The cameraman photographs the copy through a screen that is ruled with crosslines
3. The cameraman photographs the copy through a screen that is covered with dots of different sizes
4. The cameraman photographs the copy through a blue filter

3-23. The photograph you are retouching does not "take" the watercolor. What should you do?
1. Use crayon instead of watercolor
2. Rub the photograph with a very fine sandpaper
3. Rub the photograph with a piece of cotton and fuller's earth
4. Apply a thin film of rubber cement to the photograph

3-24. Which of the following materials is used in airbrushing photographs?
1. Watercolor
2. Photo oils
3. Charcoal powder
4. Thinned india ink

3-25. For which of the following purposes would you use a frisket?
1. To mask off an inset area on a photograph
2. To indicate color separation when the colors overlap
3. To mask off an area that is not to be sprayed with an airbrush
4. To produce a shading effect in line copy

3-26. Which of the following methods may be used effectively to blend together the various pictures of a photomontage?
1. Airbrushing
2. Frisketing
3. Bendaying
4. Dry mounting

3-27. To avoid possible damage to a polaroid photograph, you should mount it on cardboard with
1. any all-purpose glue
2. rubber cement
3. either 1 or 2 above
4. wax

In items 3-28 through 3-30, select from column B the term that is described in column A.

	A. Descriptions	B. Terms
3-28.	A halftone that has had its background eliminated	1. Vignette
		2. Crop
3-29.	A photograph that has a portion marked off for elimination	3. Square finish
		4. Outline
3-30.	A conventional rectangular halftone	

3-31. Which of the following methods can you use to crop a photograph?
1. Outline the section to be used with chinese white
2. Mark the margin with grease pencil or ink
3. Cover the photograph with a sheet of paper and cut a window to expose the area to be used
4. Use any of the above methods

3-32. Assume that you have a piece of copy 8 inches wide and 10 inches deep that is to be reduced to a width of 6 inches. What will the new depth be?
1. 7 in.
2. 7 1/2 in.
3. 8 in.
4. 8 1/2 in.

3-33. Of the following media, which is best for black and white reproduction?
1. Crayon drawings
2. Color photographs
3. Transparencies
4. Both 2 and 3 above

3-34. What should you do when you wish to reproduce a clipping of a halftone that has coarse dots?
1. Treat it as a halftone
2. Use a fine grain filter
3. Rescreen it
4. Treat it as a line shot

3-35. A piece of art that covers an entire page with no white space-margin is called a
1. run
2. picture inset
3. bleed
4. crop-off

3-36. What method do you use to handle a piece of art that is to cover a page from margin to margin without a border?
1. Trim it to exact size that it is to appear after reproduction
2. Rescreen it
3. Make it wider and higher than it is to appear after reproduction
4. Print it on smaller paper stock

3-37. In preparing an inset, follow all of the following procedures except
1. scaling the inset accurately to fit the area
2. indicating instructions on the overlay to the stripper
3. indicating the inset area with black paper
4. sizing small photos larger than the inset area

A. Paste lettering directly to the photograph
B. Attach lettering for the combination copy on a separate acetate overlay
C. Affix register marks to the master copy and overlay
D. Mount each element of the combination copy on separate sheets of cardboard
E. Use either A or B above

List 3B

3-38. What method in list 3B may you use to achieve an acceptable lettering and photograph combination copy?
1. B
2. C
3. D
4. E

3-39. A high quality type and photograph combination copy may be obtained by using which of the methods in list 3B?
1. A
2. B
3. D
4. E

3-40. Which method in list 3B may be used to obtain an economical combination copy?
1. A
2. B
3. C
4. E

3-41. A combination copy in which the lettering must fall at a precise point on the photograph may be obtained by which method in list 3B?
1. A
2. B
3. C
4. D

3-42. White lettering that is printed onto a photographic background is a form of reverse combination copy.

3-43. What material should you provide to the cameraman when you are preparing line copy for printing in three colors that do not overlap?
1. Three separate color drawings
2. A black and white drawing
3. An original color photograph
4. Three color photographs

3-44. What is meant by the indication "25 percent tint" on art?
1. Twenty-five percent of the tint area is to be covered by dots
2. Twenty-five percent of the tint area is to be white space
3. The ink used in printing is to be mixed 25 percent ink and 75 percent thinner
4. The ink used in printing is to be mixed 25 percent thinner and 75 percent ink

3-45. How many acetate overlays are necessary in the preparation of artwork that has four colors which overlap?
1. One
2. Two
3. Three
4. Four

3-46. Which of the following checks should you make during your review of artwork prior to sending it to the cameraman?
1. Check to see that each piece of art is marked for the desired reproduction
2. Check to see that special instructions are clearly stated
3. Check to see that all illustrations are properly scaled and marked for size and crop marks are plainly indicated
4. Perform all of the above checks

3-47. Which of the following elements should be excluded from paste-ups?
1. Reproduction proofs
2. Line drawings
3. Halftone illustrations
4. Rules and borders

3-48. Preliminary rulings for cold type paste-up should be made first in blue and then outlined in india ink.

3-49. Paste-ups for cold type composition can be be made wider and higher and later reduced to the final printed size.

3-50. Excess rubber cement should be removed from paste-ups by rubbing over it with a ball of dried rubber cement.

3-51. An advantage in using wax rather than rubber cement in paste-up work is that the wax
1. is applied only to the drawing paper
2. permits easier repositioning of copy, if necessary
3. can only be used for large quantities of work
4. requires no special applicators

3-52. Which of the following artwork can you use in its original form without obtaining permission from the publisher?
1. An illustration from the local newspaper
2. A cartoon from Esquire magazine
3. An illustration from Popular Science magazine
4. A cartoon from a Navy publication

Learning Objective: Recognize the principles of light and color and their application to photography

---

3-53. Why are light bulbs considered luminous?
1. They reflect light
2. They absorb light
3. They generate light
4. They refract light

3-54. A light tray is the name given to
1. a narrow cylinder of light
2. the smallest portion of light
3. a large volume of light
4. all of the above

3-55. Which wave length has the highest frequency?
1. A one-inch wave length
2. A one-foot wave length
3. A one-yard wave length
4. A three-yard wave length

3-56. The electromagnetic spectrum consists of all of the following types of waves except
1. X-rays
2. light waves
3. radio waves
4. sound waves

3-57. Sound waves are unlike light waves in that sound waves
1. that are extremely long and those that are very short are undetected by human senses
2. are detectable as combinations of wave lengths and frequencies
3. become weaker as they travel away from the source
4. consist of physical compression of the air

3-58. Which light rays are of too high frequency to be seen by the human eye?
1. Infrared
2. Ultraviolet
3. Violet
4. Red

3-59. The colors of the electromagnetic spectrum include (A) ultraviolet, (B) red, (C) infrared, and (D) violet. In which of the following alternatives are these light waves arranged in sequence from the lowest to the highest frequency?
1. A, D, B, C
2. C, B, D, A
3. D, A, C, B
4. A, C, B, D

3-60. Light waves are similar to sound waves in that light rays may be
1. absorbed
2. transmitted
3. reflected
4. absorbed, transmitted, or reflected

In items 3-61 through 3-65, select the color in column B that is produced by the object in column A.

	A. Object	B. Color
3-61.	A red object viewed under a mercury vapor light	1. Black
3-62.	An object which reflects all wave lengths equally	2. Green
3-63.	A colored object which reflects green light waves and absorbs light waves of all other colors	3. Red
3-64.	A colored object which reflects red light waves and absorbs all the other colors	4. White
3-65.	A colored object which absorbs all the colors	

In items 3-66 through 3-69, select from column B the light passing characteristic of the substance in column A.

	A. Substance	B. Characteristic
3-66.	Frosted glass	1. Opaque
3-67.	Wood	2. Opalescent
3-68.	Glass	3. Translucent
3-69.	Waxed paper	4. Transparent

-70. Refraction of light rays occurs when the light rays strike a transparent substance at any angle except
1. 45 degrees
2. 90 degrees
3. 110 degrees
4. 150 degrees

3-71. The reflection that results when a beam of light is reflected from a rough surface is called
1. diffracted light
2. scattered light
3. diffused light
4. specular light

3-72. To produce a photographic image with a camera you need
1. a means of making the image visible and permanent
2. a source of light
3. a light-sensitive plate or film
4. all of the above

3-73. In which area of an exposed film do the suspended silver salts undergo the greatest change?
1. In the areas where the light is reflected from the dark subject
2. In areas corresponding to the heavy shadows of the subject
3. In the areas corresponding to the light or white areas of the subject
4. In the areas corresponding to the light and medium shadows of the subject

3-74. Hypo is used to dissolve unexposed silver salts during film processing so that the
1. film will develop more quickly
2. image will be inverted
3. unexposed salts will not be affected by the actinic action of light
4. unexposed salts will not corrode the camera

Assignment 4

Photographic Equipment (Continued)

Textbook NAVEDTRA 10452-C: Pages 99-126

Learning Objective: Describe various components of the process cameral and recognize their functions.

4-1. The darkroom process camera is built into the darkroom wall to permit the cameraman to focus the camera, load the film, make the exposure, and develop the film without leaving the darkroom.

4-2. The three planes of a process camera consist of the
1. lens plane, focal plane, and lamp plane
2. focal plane, copy plane, and lens plane
3. copy plane, lamp plane, and focal plane
4. lens plane, copy plane, and lamp plane

4-3. Usually what is the movability of the planes of the process camera for focusing?
1. Movable lens plane, immovable focal and copy planes
2. Immovable focal plane, movable copy and lens planes
3. Movable copy and focal planes, immovable lens plane
4. Immovable copy plane, movable lens and focal planes

4-4. If a process camera is out of focus and the copy plane is fixed, the cameraman would adjust the focus by using cranks or handwheels to move
1. the back of the camera
2. the arc lamps
3. the lensboard
4. both 1 and 3 above

4-5. Assume that a process camera is set for a same-size shot. If the distance between the lensboard and the film is decreased, the image size will be
1. enlarged
2. reduced
3. unchanged
4. distorted

4-6. What is the purpose of the ground glass at the back of a process camera?
1. To protect the film from dust
2. To provide a flat surface for the film holder
3. To transfer the image to the film
4. To aid in focusing the camera

4-7. Before the cameraman makes an exposure, he removes the ground glass and then moves the film holding device into place which holds the film by means of
1. suction or a sticky substance
2. a sticky substance or air pressure
3. masking tape or suction
4. air pressure or rubber cement

Learning Objective: Determine the functions and characteristics of the lens in the formation of a photographic image on a process camera.

4-8. In the pinhole camera, why is the image on the film reversed and upside down?
1. The light rays reflect obliquely from the copy and through the pinhole
2. The pinhole permits only one of the many light rays reflected from each point on the copy to reach the film
3. Light rays reflected from the copy travel in straight lines and cross as they pass through the pinhole
4. Light rays reflected from the copy travel obliquely and are bent as they pass through the pinhole

4-9. A larger opening in the pinhole camera permits more than one light ray from a point on the copy to enter the camera and results in a blurred image. By what means can the larger opening on the process camera be controlled?
1. By the bellows
2. By movement of the copyboard
3. By the use of a lens in the opening
4. By decreasing exposure time

4-10. Simple lenses cannot form sharp images because the light rays
1. come to a focus too close to the lens
2. are prevented from bending
3. bend more when they pass through the edge of the lens than when they pass through the center of the lens
4. bend more when they pass through the center of the lens than when they pass through the edge of the lens

4-11. A lens that spreads the light rays is called a
1. simple lens
2. positive lens
3. double convex lens
4. negative lens

4-12. At which distance between the lens and the copy will the light rays focus an image nearest to the lens?
1. 12 inches
2. 18 inches
3. 24 inches
4. 28 inches

4-13. Depth of focus is of less importance with a process camera than with a regular camera because with a process camera the cameraman
1. uses an absolute focus
2. shoots from flat copy
3. sets the copy close to the lens
4. focuses at infinity

4-14. To determine the focal length of a lens you set the process camera for a same size shot. The copyboard is 2 feet from the lens. What is the focal length of the lens?
1. 12 inches
2. 16 inches
3. 24 inches
4. 48 inches

4-15. What determines the size of the image of a process camera?
1. The focal length of the lens
2. The distance between the copy and the lens
3. The distance between the film and the lens
4. All of the above

4-16. Varying the distance between the film and the lens affects the
1. size of the image only
2. time of exposure only
3. size of the image and the time of exposure
4. amount of distortion only

4-17. If the distance between the lens and the film is increased from 1 foot to 4 feet, the time required for the exposure will be increased by
1. 4 times greater than the original exposure
2. 8 times greater than the original exposure
3. 16 times greater than the original exposure
4. 32 times greater than the original exposure

4-18. What does each f-number on a camera's lens collar represent?
1. The distance between the lens and the film
2. A fraction of the focal length of the lens
3. The distance between the lens and the copy
4. A fractional part of the distance between the copy and the image on the film

4-19. Your process camera has a lens with a focal length of 16 inches. When you set the collar at f/32 what size lens opening will the diaphragm form in the lens barrel?
1. 1/2 inch
2. 1 inch
3. 2 inches
4. 4 inches

4-20. What is the purpose of a Waterhouse stop?
1. To increase the lens opening to a larger aperture than the largest setting on the lens barrel
2. To control the length of the exposure
3. To provide an aperture smaller than that marked on the lens barrel
4. To automatically regulate the amount of light entering the camera

4-21. Which f-number indicates the smallest aperture?
1. f/8
2. f/16
3. f/32
4. f/64

4-22. Maximum f-number openings of four cameras are: Camera (A) f/5.6, camera (B) f/2.8, camera (C) f/4, and camera (D) f/8. Which camera has the fastest speed?
1. A
2. B
3. C
4. D

4-23. Why should the lens be stopped down one or two stops from the largest lens opening when making the exposure?
1. To shorten exposure time
2. To decrease the effects of vibration
3. To improve image sharpness
4. To protect the lens

4-24. A 40-second exposure at f/45 will require ___(A)___ seconds at f/64 or ___(B)___ seconds at f/32.
(A) 20, 60, 80
(B) 20, 60, 80
1. (A) 80; (B) 20
2. (A) 20; (B) 80
3. (A) 60; (B) 80
4. (A) 80; (B) 60

4-25. A camera is equipped with the major lens openings. If a lens opening of f/32 is changed to f/64, by how many times must the relative exposure time be increased?
1. Two
2. Four
3. Six
4. Eight

Learning Objective: Recognize the function of the lens diaphragm control system and the lens shutter, and identify lens aberrations, flare, and care of the lens.

4-26. What is the purpose of the lens diaphragm control system?
1. To automatically control the exposure time regardless of the camera extension
2. To permit opening and closing the lens aperture without changing the exposure time
3. To correct the aberrations of the lens
4. To reduce or eliminate the amount of flare caused by the lens

4-27. The purpose of the shutter is to
1. control the passage of light through the lens
2. regulate the size of the lens aperture
3. activate the camera lamps
4. provide an aperture smaller than that marked on the lens barrel

4-28. The operator of a shutterless process camera controls the exposure time by means of a
1. Waterhouse stop
2. filter
3. lens cap
4. lens shade

4-29. Manufacturers often combine lenses made of crown and flint glass to correct for
1. spherical aberration
2. curvature of field
3. chromatic aberration
4. flare

In items 4-30 through 4-33, select the lens aberration in column B that is described by the characteristic in column A.

	A. Characteristic	B. Aberration
4-30.	Colored image is blurred or outlined.	1. Chromatic
4-31.	Straight lines of the image appear curved.	2. Curvature of field
4-32.	Image is fuzzy along the margins.	3. Distortion
4-33.	Center of the image is out of focus when the margins are in focus.	4. Coma

---

4-34. Which aberration occurs if either the vertical lines or the horizontal lines of the image are blurred?
1. Chromatic
2. Distortion
3. Spherical
4. Astigmatism

4-35. Which type of aberration results when the light rays passing through the outer edges of the lens focus on a different plane from those passing through the center?
1. Spherical
2. Coma
3. Astigmatism
4. Distortion

4-36. A ghost on a negative may be caused by
1. the reflection of light within the lens barrel
2. astigmatism
3. the lens shade
4. the filter

4-37. By which of the following methods may you reduce flare?

1. By changing the angle of the lighting
2. By using a lens hood
3. By using a dull, black lensboard
4. By doing any of the above

4-38. What are the proper materials to use for cleaning a lens?

1. Carbon tetrachloride and a camel's hair brush
2. Commercial lens cleaner and lens tissue
3. Soft cloth moistened with alcohol
4. Ammonia water and a soft cloth

4-39. Care of the lens includes all of the following practices except

1. stowing the lens in a place that has relatively stable temperature
2. protecting the lens from air
3. taking the lens apart for cleaning
4. covering the lens barrel with a cap when the camera is not being used

---

Learning Objective: Recognize the purpose and use of filters and the functions and operation of the lensboard, copyboard, bellows, and the back of the process camera.

4-40. For what reason/reasons are filters used?

1. To alter the color for color correction
2. To separate the primary colors in process color work
3. To change the intensity of the light for color correction
4. To do all of the above

4-41. For which reason would you use a yellow filter to photograph a newspaper dated July 1893 which has yellowed with age?

1. To neutralize the blues in the picture
2. To absorb the reds in the picture
3. To make the background photograph yellow
4. To make the background photograph white

4-42. What is the filter factor of a film?

1. The aperture setting for a particular filter
2. The names of the colors absorbed by the filter
3. The number of times the exposure must increase when a filter is used
4. The type of lighting and the aperture setting to be used with a particular filter

4-43. The amount of reduction and enlargement that can be obtained by a process camera is limited by

1. the distance the lensboard can be moved
2. the length of the camera bed
3. the distance the copyboard can be moved
4. all of the above

4-44. The process camera discussed in your textbook has a 90-inch bed, and the lensboard is equipped with a 12-inch lens and a 16-inch lens on a turret mount. Which of the following exposures may you make with either of the lenses?

1. 300 percent enlargement
2. 400 percent enlargement
3. 25 percent reduction
4. 20 percent reduction

4-45. If your process camera is not equipped with a lens turret, the lens is screwed into

1. an opening in the lensboard
2. an opening in the copyboard
3. the filter slot in the lens barrel
4. the slot for the Waterhouse stop

4-46. What is the purpose of the reference lines on a copyboard?

1. To help you align the copyboard with the camera bed
2. To help you position the copy
3. To aid in attaching the lamps to the copyboard
4. To help you align the copyboard in the vertical position

4-47. The copy is held in place in the copyboard by either

1. spring pressure or masking tape
2. suction or spring pressure
3. suction or rubber cement
4. spring pressure or rubber cement

4-48. Care of the copyboard includes all of the following practices except
1. moving the copyboard when it is in the horizontal position
2. cleaning the glass cover with a soft cloth and ammonia water
3. scraping the glass cover, when necessary, with your fingernail
4. locking the glass cover before moving the copyboard from the horizontal to the vertical position

4-49. The light tunnel from the lens to the back of the camera is formed by the
1. accordian
2. lens barrel
3. bellows
4. camera extension

4-50. A magnifying glass is used to examine the image on a ground glass in order to check the
1. amount of lint on the film
2. focusing of the fine lines on the ground glass
3. bellows extension
4. amount of dust on the ground glass

4-51. Components of the back of the process camera include
1. the negative carrier
2. the camera controls
3. the ground glass
4. all of the above

4-52. After you position the film on the vacuum back, you notice the film reflecting light from the darkroom safelights. What action should you take?
1. Apply vacuum to all channels of the vacuum back
2. Adjust the suction to the channels beneath the film
3. Tape the film firmly to the vacuum back
4. Do either 2 or 3 above

4-53. For which of the following jobs would you find it necessary to insert a halftone screen in the holding device of the process camera?
1. Photographing lettering
2. Copying tone drawings
3. Photographing pen and ink drawings
4. Copying scratchboard drawings

4-54. Which shape of glass halftone screen is used primarily for color-separation?
1. Circular
2. Rectangular
3. Square
4. Elliptical

Learning Objective: Determine the operation of the focusing controls and the types and positioning of camera lamps.

4-55. Which of the following information does the cameraman obtain from a scaling wheel?
1. The distance of the lens from the film
2. The distance of the copy from the lens
3. The percentage of reduction or enlargement of the copy being photographed
4. Both 1 and 2 above

4-56. Assume that you have determined that the copy has to be enlarged 40%. To position the lensboard and copyboard for this enlargement, you turn left handwheel until you read $\underset{40\%,\ 140\%}{\underline{\quad (A) \quad}}$ through the lensboard window and turn the right handwheel until you read $\underset{40\%,\ 140\%}{\underline{\quad (B) \quad}}$ through the copyboard window.
1. (A) 140%; (B) 40%
2. (A) 40%; (B) 140%
3. (A) 140%; (B) 140%
4. (A) 40%; (B) 40%

4-57. The purpose of the lens calibration chart of a large process camera is to convert enlargement or reduction percentages to numeral settings for the camera's lensboard and copyboard.

4-58. Which of the following formulas does the cameraman use to aid him in finding the distance between the lensboard and the copyboard when he is focusing by sight?
1. Focal length x (1 + magnification)
2. Focal length x $\left(1 + \frac{\text{magnification}}{1}\right)$
3. Focal length x (1 + magnification)
4. Focal length x $\left(1 + \frac{1}{\text{magnification}}\right)$

4-59. Assume that your process camera is equipped with a 12-inch lens. For a copy to be reduced one-half, what is the distance between the copyboard and the film?
1. 18 inches
2. 36 inches
3. 54 inches
4. 72 inches

4-60. Which of the following light sources for graphic arts reproduction is becoming obsolete?
1. The iodine quartz lamp
2. The carbon arc lamp
3. The mercury vapor lamp
4. The pulsed xenon lamp

4-61. All of the following lamps are of the electric discharge type except the
1. pulsed xenon lamp
2. iodine quartz lamp
3. short-arc mercury lamp
4. short-arc xenon lamp

4-62. Which characteristic of the mercury lamp prevents its use in photographing color copy?
1. The extreme intensity of the lamp
2. The tarnishing of the lamp by deposits from the filament
3. The low intensity of the lamp
4. The lack of some colors of the color spectrum

4-63. What positioning of the lamps will generally prove satisfactory?
1. Approximately 3 feet in front of the copyboard at a 45° angle
2. As near the lensboard as possible and with the light beam forming a 75° angle on the copyboard
3. At points parallel to one-third the distance from the copyboard to the lensboard
4. Approximately 3 feet in front of the copyboard at a 75° angle

4-64. If you rearrange the camera lamps to achieve balance, you may also have to increase or decrease the
1. light intensity
2. exposure time
3. bellows extension
4. number of lamps

4-65. Which safety precaution should you observe while using the camera lamps?
1. Secure the power before adjusting the light source
2. Never look directly into the lamp
3. Turn off the power before replacing the lamp
4. Do all of the above

Learning Objective: Recognize the operating characteristics and capabilities of the vertical process camera and automated cameras.

4-66. Which feature of the Kenro vertical process camera allows the camera to be located in a room other than the darkroom?
1. The camera may be equipped with a stayflat back
2. The camera has a movable back for focusing
3. The camera may be equipped with a vacuum back
4. It is not necessary to use the ground glass for visual focusing

4-67. Where are the standard camera lights of the Kenro vertical process camera located?
1. Attached to the lensboard
2. Within the lamp housings
3. Attached to and in front of the copyboard
4. Attached to and behind the copyboard

4-68. Where is the lighting system of the Density Modulator located when the Density Modulator is used with the Kenro camera?
1. Behind the copy inside the copyboard
2. Freestanding in front of the copyboard
3. Within the Kenro's lamp housings
4. In front of the copy inside the copyboard

4-69. Which equipment enables the cameraman, while outside the darkroom, to load the film, make several exposures, and develop the film in one continuous operation?
1. The horizontal process camera
2. The Kenro vertical process camera
3. The automatic camera and the automatic film processor
4. The Kenro vertical process camera and the Density Modulator

Assignment 5

Photographic Equipment (Continued); Photographic Materials

Textbook NAVEDTRA 10452-C: Pages 126-150

Learning Objective: Recognize darkroom equipments and their functions.

5-1. In the absence of an air-conditioner, the darkroom should be furnished air by a
   1. ventilating fan and an exhaust fan
   2. filtered blower and a ventilating fan
   3. fresh air vent and a ventilating fan
   4. filtered blower and a fresh air vent

5-2. Why is the temperature controlled darkroom sink an advantage over the nontemperature controlled sink?
   1. It has a refrigerated compartment for film storage
   2. The trays are non-corrosive
   3. It maintains a constant temperature of the processing solutions
   4. It does both 1 and 3 above

5-3. The film processing section of the film processor contains: (A) a wash tank, (B) a developer tank, and (C) a fix tank. In which sequence is the exposed film conveyed through these tanks?
   1. C, B, A
   2. B, C, A
   3. B, A, C
   4. C, A, B

5-4. What is the purpose of the densitometer?
   1. To measure the blackness of negative or opaque copy
   2. To measure the concentration of darkroom solutions
   3. To provide back lighting for copying film positives
   4. To eliminate shadows from paste-ups and overlays

5-5. For what reason is the density of a halftone called the integrated tone density?'
   1. Because it depends only on the size and opacity of the dots
   2. Because it deals with the amount of light reflected from the print
   3. Because it deals with the opacity and size of dots and the clear space around the dots
   4. Because it depends on the amount of light passed through the film emulsion

5-6. Why is the visual densitometer considered less accurate than the electronic densitometer?
   1. It is more simple in design
   2. It is less complicated to operate
   3. The visual densitometer costs less
   4. It involves the visual judgment of the operator

5-7. The head of the photoelectric densitometer may be used for
   1. evaluating colored papers and inks
   2. checking the ground glass or copyboard for even illumination
   3. calculating filter factors and exposures
   4. any of the above

5-8. The type of safelight used in darkrooms depends mainly upon the
   1. kind of sensitized material being used
   2. wattage rating of the bulb
   3. size of the work area in the darkroom
   4. electrical power available in the darkroom

5-9. What type of safelight, if any, may you use to inspect panchromatic film during developing?
   1. Green
   2. Red
   3. Violet
   4. None

5-10. What is the source of heat that dries the film in the Dryedge film dryer?
   1. A forced hot air blower
   2. The pump motors
   3. High wattage incandescent lamps
   4. A high resistance electrical heating element

5-11. What precaution should you use during film processing if you are going to use the film dryer in your Navy shop?
   1. Use fresh, cool, clean wash water
   2. Assure yourself that the fixing solution is not aging
   3. Make sure that the fixing solution contains hardener
   4. Do all of the above

5-12. Which positions of knob A, the speed control knob, and knob B, the damper control knob, of the Dryedge film dryer will cause the film to dry faster?
1. (A) counterclockwise, and (B) pulled out
2. (A) clockwise, and (B) pulled out
3. (A) counterclockwise, and (B) pushed in
4. (A) clockwise, and (B) pushed in

5-13. What maintenance should you perform on the Dryedge film dryer approximately every three months?
1. Remove the foreign matter from the bottom near the front
2. Replace the intake filter pad
3. Remove and clean the drive and air
4. Do all of the above

5-14. The operator should squeegee the film before feeding the film into the Southwind automatic film dryer.

5-15. What determines the amount of heat necessary for drying film in the film dryers?
1. The type of film and the relative humidity of the room
2. The relative humidity and temperature of the room
3. The temperature of the room and the type of film
4. The type of film and the type of heating unit

5-16. What name is given to a positive copy on paper?
1. Transparency
2. Print
3. Film positive
4. Negative

5-17. Masks are used in contact printers to
1. prevent the negative from tearing
2. provide white margins around the prints
3. reduce the amount of light on the negative
4. increase the exposure time

5-18. Which of the following printing equipment is generally used to make positive prints on film?
1. Printing frame
2. Contact printer
3. Projection printer
4. Vacuum printer

5-19. Which of the following photographic printing equipment is generally used for making film transparencies?
1. Printing frame
2. Contact printer
3. Projection printer
4. Vacuum printer

5-20. Glossy prints generally are dried on
1. cheesecloth
2. blotting paper
3. ferrotype plates
4. a clothes line

5-21. One way to join a separated mercury column in a thermometer is to
1. plunge the thermometer into boiling water
2. let the thermometer stand overnight
3. put the thermometer under refrigeration
4. heat the thermometer gradually in a pan of water

Learning Objective: Recognize the health and safety precautions to be observed when working with photographic equipment.

Items 5-22 through 5-27 are to be judged True (a good practice) or False (a bad practice) based on the following situation: LI3 Burns is assigned to a shop that has a darkroom equipped with a vertical process camera, a Southwind automatic film dryer, and a temperature controlled sink with a viewing glass on the right hand side. Burns is working with black and white copy.

5-22. Burns places the trays of developer, fixer, and water into the sink and spills some of the fixer on the viewing glass. He wipes the viewing glass clean.

5-23. He then fills the last tray of the sink with fresh water, getting some on his hands, and turns the camera lamps to normal brightness.

5-24. He discovers that one of the two camera lamps in the housing is burned out. He leaves the one lamp on while he removes and replaces the burned out lamp.

5-25. Burns turns the camera lamps off and finds that he has to use a long extension cord to connect the Southwind dryer to an electrical outlet.

5-26. He presses the "Low" button of the dryer switch to permit the dryer to warm up. The dryer doesn't begin to warm. Burns notifies the electricians.

5-27. Burns carefully avoids leaning on the viewing glass.

Learning Objective: Recognize the fundamentals of chemistry and their relationship to photography, photographic emulsions, and photographic bases.

5-28. What chemical term is given matter that cannot be broken down or divided by chemical means?
1. Compound
2. Substance
3. Mixture
4. Element

5-29. Which of the following matter is an element?
1. Oxygen
2. Water
3. Silver nitrate
4. Air

5-30. What name is given to two or more elements that chemically combine in a fixed proportion?
1. Mixture
2. Substance
3. Compound
4. Emulsion

5-31. Into which classes are elements divided?
1. Solids, liquids, and gases
2. Non-metals, metals, and inert gases
3. Acids, bases, and gases
4. Metals, non-metals, and liquids

5-32. All of the following combinations of elements will result in a reaction except
1. iron and oxygen
2. silver and helium
3. sulphur and iron
4. carbon and oxygen

5-33. Which of the following combinations form bases or alkalies?
1. Non-metal with water
2. Non-metal with hydrogen
3. Metal oxide with water
4. All of the above combinations

5-34. What is produced by combining a non-metal with either water or hydrogen alone?
1. An acid
2. A base
3. A salt
4. A halogen

5-35. A chemical reaction that produces a salt compound results from the combination of
1. one metal with another metal
2. a base with another base
3. an acid with another acid
4. an acid with either a base or a metal

5-36. Whether a salt is an acid salt, a basic salt, or a neutral salt depends upon the amount of hydrogen displaced during neutralization.

5-37. A system devised for measuring the degree of activity of an acid or an alkali in solution and expressed in numerical values is known as
1. pF factor
2. pH control
3. concentration
4. neutralization

5-38. Which of the following pH values has the greatest acidity?
1. 5
2. 6
3. 7
4. 8

5-39. Which of the following pH values is the most alkaline?
1. 6
2. 7
3. 8
4. 9

5-40. A solution with a pH value of 4 is how many times more acid than a solution that has a pH value of 6?
1. 10
2. 100
3. 1,000
4. 10,000

5-41. What is the most accurate method of determining the pH value of a solution?
1. Test strip
2. Litmus paper
3. Electrometric
4. Colorimetric

5-42. In a photographic emulsion, the substance which holds the light-sensitive particles in suspension is called
1. silver nitrate
2. metallic silver
3. sodium chloride
4. gelatin

5-43. Increasing the size of silver halide crystals increases the sensitivity and speed of a film emulsion. Which procedure in mixing an emulsion produces the fastest film?

1. The slow addition of cold silver nitrate solution to a cold halide solution
2. The rapid addition of warm silver nitrate solution to a warm halide solution
3. The slow addition of warm silver nitrate solution to a warm halide solution
4. The rapid addition of cold silver nitrate solution to a cold halide solution

5-44. What is the purpose of ripening an emulsion?

1. To form a protective coating
2. To make the emulsion flow onto the supporting base
3. To form larger crystals
4. To form smaller crystals

5-45. Materials that may serve as a base for photographic emulsion include

1. paper
2. plastics
3. glass
4. all of the above

5-46. Which photographic base, if used properly, is more economical for most line work?

1. A paper negative with a translucent base
2. Glass plate
3. A paper negative with a white semiopaque base
4. Process film

5-47. For what purpose is a coating of dye placed between the film base and the emulsion of photomechanical film?

1. To prevent curling
2. To prevent internal reflection
3. To form a protective cover
4. To reduce stretching

5-48. You are working in the darkroom with sheet film that is notched. For the emulsion side of the film to face you, you should position the notch

1. at the bottom and to the right
2. along the left edge at the top
3. along the left edge at the bottom
4. at the top and to the right

Learning Objective: Describe the characteristics of film emulsions, determine the kind of film for a particular application, and distinguish between the types of exposures.

5-49. What is meant by the color sensitivity of a film emulsion?

1. The difference in densities of the various areas of the negative
2. The ability of the film emulsion to translate colors into shades of gray
3. The ability of the film to translate colors into black areas on the film
4. The ability of the emulsion to accept sensitizing dyes

5-50. Which of the following films is best suited for color separation work?

1. Regular
2. Color blind
3. Orthochromatic
4. Panchromatic

5-51. The variation of density of the areas of a negative is known as

1. color sensitivity
2. resolving power
3. contrast
4. comparison

5-52. In which characteristics does the process film emulsion differ from the continuous-tone film emulsion?

1. Relative sensitivity, contrast, and grain size
2. Contrast, general composition, and relative sensitivity
3. General properties, grain size, and contrast
4. General composition, general properties, and relative sensitivity

5-53. For what reason is continuous-tone film used to photograph snapshots?

1. It produces a sharp black and white
2. It is contrasty
3. It has a wide range of tonal values
4. It produces intermediate gray areas as black

5-54. If a job is to be printed on the offset press, the line work should be copied with process film and all tone work should be copied with continuous-tone film.

5-55. In offset printing, ________(A)________
process, continuous-tone
film is used for both half-tone and line negatives because ____(B)____ contrast
low, high
is required to produce printing images with sharply defined printing areas.

1. (A) continuous-tone; (B) high
2. (A) process; (B) low
3. (A) continuous-tone; (B) low
4. (A) process; (B) high

5-56. Assume that you are using process film for continuous-tone work. To process the film, you may compensate for the substitution by

1. decreasing the strength of the developer
2. increasing the strength of the developer
3. decreasing the strength of the fixer
4. increasing the strength of the fixer

5-57. Which of the following films has the best resolving power?

1. A very fine grained film
2. A fine grained film
3. A coarse grained film
4. A very coarse grained film

5-58. Which characteristic of film is indicated by the film exposure index?

1. Age of the film
2. Color sensitivity of the film
3. Contrast of the film
4. Speed of the film

5-59. Assume that your shop has been using a general-purpose film with an exposure index of 5 and making 40 seconds exposure at f/22 for a same-size line shot. Your last supply of general-purpose film has an exposure index of 10. What exposure do you give this film at f/22 for a same-size line shot?

1. 10 seconds
2. 20 seconds
3. 60 seconds
4. 80 seconds

5-60. Films are assigned a higher exposure index for daylight and a lower index for tungsten light because compared with daylight, tungsten light provides

1. more blue-violet color
2. less infra-red color
3. less blue-violet color
4. more ultra-violet color

5-61. Which portion of the characteristic curve of a film represents the middletone areas?

1. The foot
2. The shoulder
3. The straight-line area
4. The apex

5-62. The gamma of the characteristic curve for a film is a numerical term indicating the

1. exposure index
2. development contrast
3. bellows distance
4. development time

Learning Objective: Recognize the composition and characteristics of developing solutions and specify how developer is mixed.

5-63. The process of converting a latent image on an emulsion to a visible image by chemical action is called

1. developing
2. oxidizing
3. fixing
4. exposing

5-64. The most active ingredient of the developing solution is called a

1. restrainer
2. reducer
3. preservative
4. buffer

In items 5-65 through 5-68, select the ingredient in column B which may be added to a developing solution to serve the purpose in column A.

	A. Purpose	B. Ingredient
5-65.	To slow the rate of oxidation	1. Preservative
5-66.	To inhibit fogging and slow down the speed of development	2. Accelerator 3. Restrainer
5-67.	To control the alkalinity of the developer	4. Buffer
5-68.	To speed up the development	

5-69. The useful life of a developer is affected by

1. the age of the developing solution
2. the amount and type of film developed
3. the ratio of exposed to unexposed film area
4. all of the above

Assignment 6

Photographic Materials (continued); **The Line Negative**

Textbook NAVEDTRA 10452-C: Pages 150-169

Learning Objective (continued): Recognize the composition and characteristics of developing solutions and specify how the developer is mixed.

6-1. In which form are manufacturers presently producing developers?
1. Powdered form
2. Diluted liquid form
3. Concentrated liquid form
4. Ready mixed liquid form

6-2. Why should you dilute part A stock solution and part B stock solution before you mix them together?
1. To prevent the crystals from spotting the film during developing
2. To prevent rapid deterioration of the developer
3. To reduce the possibility of an explosion
4. To reduce the fogging action of the developer

6-3. What aging period, if any, is required for developer mixed with the liquid stock solutions A and B?
1. None
2. 12 hours
3. 24 hours
4. 36 hours

6-4. Which temperature of the developer will produce the most satisfactory negative during processing?
1. 50°F
2. 68°F
3. 75°F
4. 125°F

6-5. Reticulation of an emulsion may be caused by
1. excessive development time
2. low temperature of the developer
3. insufficient development time
4. high temperature of the developer

6-6. When temperature conditions cannot be corrected, what chemical agent may you add to the developer to permit processing at temperatures up to 110°F?
1. prehardener
2. Accelerator
3. Buffer
4. Reducer

6-7. If a normally exposed process film is developed too long, which of the following deficiencies might occur?
1. Fogging
2. Frilling
3. Reticulation
4. Blistering

6-8. If an image appears on a film one minute after it is put into the developer, approximately what would the total development time be?
1. 3 min
2. 4 min
3. 5 min
4. 6 min

6-9. For what reason should the developer be agitated before the exposed film is placed in the solution?
1. To prevent streaks
2. To assure uniform mixture of the chemical agents
3. To prevent blistering of the emulsion
4. To equalize the temperature of the solution

Learning Objective: Recognize the film processing steps and composition of the solutions from the developing step through the reduction or intensification corrections.

6-10. Which of the following conditions may occur if a negative is not washed before fixing?
1. Fogging
2. Overdevelopment
3. Blistering
4. Underdevelopment

6-11. Washing developed film with dilute acetic acid is preferable to washing with water because the acid
1. increases the life of the film
2. neutralizes the fixer
3. hardens the emulsion
4. neutralizes the developer on the film

6-12. Which ingredient of the fixer prevents decomposition of the fixer?
1. Acid
2. Hyposulphite of soda
3. Sodium sulfite
4. Potassium alum

6-13. The length of fixing time depends upon the solutions used and the type film and varies for a period of
1. 3 to 9 min
2. 1 to 5 min
3. 1 to 7 min
4. 10 to 20 min

6-14. When can you safely remove a negative from the fixing solution?
1. When the gelatin has toughened
2. As soon as the unexposed emulsion has cleared
3. When the emulsion becomes cloudy
4. As soon as the alkalies have neutralized

6-15. What determines the life of the fixer?
1. The amount of developer transferred with the film
2. The ingredients of the fixer
3. The conditions under which the fixer is used
4. All of the above

6-16. When you are to save a film for future use, how many minutes should you wash it in running water after taking it from the fixing solution?
1. 1 to 2 min
2. 1 to 5 min
3. 6 to 10 min
4. 10 to 20 min

6-17. The fresh water supply is limited aboard ship and you have negatives that are to be saved. How long should you wash the negatives in sea water?
1. 1 to 2 min
2. 5 to 10 min
3. 10 to 15 min
4. 10 to 20 min

6-18. Why should you keep the solutions at the same temperature during film processing?
1. To prevent frilling
2. To prevent reticulation
3. To prevent blistering
4. To prevent all of the above

6-19. Any of the following methods may be employed to dry the film except
1. using a hot air drier
2. hanging it in a drying cabinet
3. using a commercial film drier
4. hanging it in a warm, dry room

6-20. You can correct a slightly fogged process film negative by immersing the negative in
1. developer
2. intensifier
3. reducer
4. fixer

6-21. Intensifiers increase the density of silver grains in the emulsion by adding
1. oxides to the silver grains
2. compounds of heavier metals to the silver grains
3. extra emulsion to the negative
4. any of the above

6-22. For which process negative is intensification most effective?
1. An underdeveloped negative
2. An overexposed negative
3. An overdeveloped negative
4. An underexposed negative

Learning Objective: Recognize characteristics and uses of photographic papers, duplicating film, and autopositive film and observe safety precautions applicable to photographic materials.

6-23. Negatives that require the use of No. 5 photographic paper for making contact prints include
1. contrasty negatives
2. normal negatives
3. flat, thin negatives
4. all of the above

6-24. Which of the following grades of enlarging paper is best for printing from negatives with high contrast?

1. Number 1
2. Number 3
3. Number 4
4. Number 5

6-25. By which method should you control the contrast when you make photographic prints?

1. Vary the exposure
2. Manipulate the development time
3. Select the proper paper for the type of negative
4. Do both 1 and 3 above

6-26. Which type of film may you use to produce a negative and a positive image on the same piece of film?

1. Standard photomechanical film
2. Duplicating film
3. Autopositive film
4. Any of the above

6-27. Exposure to which light will increase the density of autopositive film?

1. White light
2. Light red light
3. Yellow safelight
4. Dark red light

6-28. What can you use to neutralize a strong acid that comes in contact with your skin?

1. Vinegar
2. Bicarbonate of soda
3. Sodium cyanide
4. Water

● Items 6-29 through 6-38 are to be judged True (a good practice) or False (a bad practice), based on the following situation: While the ship is in port, LI3 Burns procures photographic supplies, stores chemicals aboard ship, and prepares solutions for the ship photographic shop which is below the waterline.

6-29. Before leaving the ship, Burns inquires about the use of x-rays by yard workers during the period in the yard because x-rays can damage film.

6-30. He then takes inventory of his onboard chemicals to see that he has a sufficient amount of carbon tetrachloride.

6-31. The concentration of the hydrogen peroxide which Burns procures, should not be greater than 30 percent.

6-32. Burns also procures five gallons of 40 percent concentrated acetic acid.

6-33. After procuring the necessary supplies, Burns returns to the ship photographic shop and stores the acetic acid in the same cabinet compartment with the potassium ferricyanide.

6-34. While arranging the supplies, LI3 Burns is careful to keep the glycerin separate from the potassium permanganate by storing each in a different cabinet.

6-35. Burns dilutes a quart of the acetic acid by adding the acetic acid to water.

6-36. He mixes the acid and the water in a two gallon container made of thick glass instead of a pyrex container.

6-37. A small amount of acetic acid remained in the quart container so Burns poured it into the ship's drainage system.

6-38. Burns reports to the sick bay when he develops a minor skin irritation.

Learning Objective: Recognize the steps and techniques used to produce line negatives from copy.

6-39. What is the primary reason for standardizing operations in the photographic shop?

1. To conserve time
2. To obtain consistent results
3. To isolate causes of darkroom problems
4. To prevent waste of materials

6-40. Which factor should the cameraman first consider when he plans his camera set-up?

1. The lens **aperture**
2. The type of film to use
3. The position of the camera lamps
4. The copy

6-41. Less exposure time is required for shooting line work if the copy is prepared on

1. tinted stock
2. rough surface stock
3. smooth, white stock
4. colored stock

6-42. For Type 3 Kodalith Ortho Film, which filter requires the longest basic exposure time?

1. Blue
2. Deep yellow
3. Light yellow
4. Green

For items 6-43 through 6-54, assume that LI3 Young is making a same size line negative from the copy accompanying a work order.

6-43. Before Young mounts the copy on the camera, he takes all of the following action except

1. checking the work order for instructions or information
2. examining the copy for apparent omissions or damage
3. using a scaling wheel to determine the focal settings
4. checking the copy for instructions or information

6-44. In what position on the copyboard will Young mount the copy?

1. At the bottom edge with the top of the image toward the lensboard
2. In the center with the top of the image toward the lensboard
3. At the top edge with the bottom of the image toward the lensboard
4. In the center with the bottom of the image toward the lensboard

6-45. Young finds that his copy has large, unnecessary white margins. What action does he take to reduce the glare from these margins?

1. Cuts them off
2. Paints them black
3. Covers them with black paper
4. Paints them red

6-46. Young considers the line negative to be normal work and sets the lamps about ___(A)___ feet from the copyboard and
three, four

sets the lens aperture at the ___(B)___
f/22, f/11
setting.

1. (A) four, (B) f/11
2. (A) four, (B) f/22
3. (A) three, (B) f/11
4. (A) three, (B) f/22

6-47. When Young focuses the camera visually, which of the following switches does he set to the manual position?

1. Shutter and arc
2. Arc and master
3. Master and shutter
4. Master, shutter, and arc

6-48. Young focuses the camera with the diaphragm wide open and checks the image on the ground glass. He then stops the lens down to the aperture he is going to use. Why should he again check the image on the ground glass?

1. A brighter image appears on the ground glass
2. The focus may have changed
3. More light is admitted to the camera
4. The image is easier to check because of 1 and 3 above

6-49. Young loads the camera with pan film. He determines the emulsion side of the film by

1. finding the light, dull side
2. locating the clipped upper right corner
3. locating the notches in the lower right corner
4. locating the notches in the upper right corner

6-50. Young obtains the exact exposure time from the manufacturer's film data sheet to set the camera's timer for the exposure.

6-51. Young properly positions the switches and selects the desired exposure time on the timer. What events occur when he pushes the start button?

1. The lamps energize
2. The timing action begins
3. The shutter opens
4. All of the above occur

6-52. By which procedure should Young develop the exposed line negative?

1. Draw the film emulsion side down through the developer, flip it over and allow it to rest on the bottom of the tray and agitate the developer vigorously
2. Draw the film emulsion side up through the developer, flip it over and allow it to rest on the bottom of the tray, and agitate the developer with a smooth, rocking motion
3. Draw the film emulsion side down through the developer, flip it over and allow it to rest on the bottom of the tray, and agitate the developer with a smooth, rocking motion
4. Draw the film emulsion side up through the developer, flip it over, and allow it to rest on the bottom of the tray, and agitate the developer vigorously

6-53. During the processing, when may Young turn on the regular lights if unexposed film in the dark room is protected?
1. In the fixer when the milky appearance leaves the image area of the film
2. As soon as the film rests on the bottom of the developer tray
3. When the film is removed from the developer
4. When the film is removed from the stop bath solution

6-54. Young determines that the negative has been properly exposed and processed by noting the sharp, clear image areas and the dense non-image areas.

6-55. You use a sensitivity guide along the edge of the typewritten sheet you are copying same-size. According to the chart, which step of the guide should be developed solid?
1. 2
2. 3
3. 4
4. 5

Learning Objective: Recognize procedures in making positive copies, negatives for color reproduction, and colored copy.

6-56. What is the name of the process used to make a positive copy of a negative by placing the negative over a piece of sensitized film and exposing to weak light?
1. Enlarging
2. Copying with a camera
3. Contact printing
4. Reducing

6-57. For copy that has three overlapping colors, how many negatives do you have to make?
1. One
2. Two
3. Three
4. Four

6-58. When you are photographing colored copy and want to make the subject light against a dark background, you should select a filter that
1. transmits the color of the subject and absorbs the color of the background
2. absorbs the color of both the subject and the background
3. transmits the color of the background and absorbs the color of the subject
4. transmits the color of both the subject and the background

6-59. What color does red appear to be when placed under a mercury-vapor lamp?
1. Red
2. Black
3. White
4. Gray

In items 6-60 through 6-64, select from column B the Wratten filter that you should use to produce the desired result, on panchromatic film, in column A.

	A. Desired result	B. Filter
6-60.	To hold blue	1. A
6-61.	To drop red	2. B
6-62.	To hold violet	3. C5
6-63.	To hold yellow	4. G
6-64.	To drop green	

6-65. Which film must you use when you have to correct a colored image with a red filter?
1. Regular emulsion
2. Orthochromatic
3. Monochromatic
4. Panchromatic

6-66. Which filter should you use to intensify pencil drawings?
1. Red
2. Yellow
3. Green
4. Blue

Learning Objective: Determine precautions when photographing classified matter.

6-67. Which of the following security precautions must you take when you photograph classified matter?
1. Handle unsatisfactory negatives and positives as classified waste
2. Account for all copy and for all positives and negatives that you produce
3. Prevent compromise by personnel not cleared for access
4. Take all of the above precautions

6-68. What is the secure method of destroying film negatives and positives?
1. Pulping
2. Burning
3. Shredding
4. Chemical decomposition

Learning Objective: Recognize causes and remedies of negative difficulties.

6-69. What is the probable cause of an image failing to appear on an exposed film immersed in pure, new developer, if the camera and lamps are eliminated as the cause?
1. Developer is too cold
2. Developer is too warm
3. Film is old
4. Film is overexposed

6-70. Which negative difficulty could be caused by using old film?
1. Negative develops too slowly
2. Negative is thin in the corners
3. Negative is veiled in clear areas
4. Negative clears too slowly in the fixing bath

6-71. Keeping all processing baths at the same temperature is one method of correcting negatives that
1. develop too quickly
2. show reticulation or blistering
3. have blurred images
4. lack overall density

6-72. For which negative difficulty should you check the image on the ground glass?
1. The clear areas on the negative are fogged
2. The negative lacks overall density
3. There are blisters on the negative
4. The image on the negative is blurred

Assignment 7

The Halftone Negative

Textbook NAVEDTRA 10452-C: Pages 171-209

Learning Objective: Describe the construction and principle of the glass halftone screen and the method of using it to produce a halftone negative.

7-1. What printing achievement did the development of the halftone make possible?
1. The reproduction of line drawings in multicolor
2. The production of illustrations from woodcuts
3. The reproduction of photographs with no loss of tone values
4. The production of tone by the use of line drawings

- Items 7-2 through 7-13 refer to the glass halftone screen.

7-2. What is the construction of the glass halftone screen?
1. Two sheets of optical glass enclosing a negative made from a lined checkerboard ink drawing
2. A sheet of optical glass etched with pigment-filled, fine, parallel lines and sealed to a similar sheet with the parallel lines crossing at right angles
3. A sheet of optical glass with pigment-filled, fine, parallel lines etched on it in a checkerboard pattern
4. Two sheets of optical glass each with pigment-filled, fine, parallel lines etched on it and sealed with the parallel lines in alignment

7-3. The crosslines of the screen break up the reflected light from the copy and register dots on the film. Other than screen distance and the intensity of the reflected light, what else influences the size of the dot?
1. The size and shape of the lens aperture
2. The length of the exposure
3. The speed and contrast of the film emulsion
4. All of the above

7-4. Two or more exposures, at different apertures, are made to produce the halftone negative. Which exposure is unnecessary if sufficient contrast can be obtained with the apertures?
1. Middletone
2. Highlight
3. Detail
4. Flash

7-5. For copy that is to be shot same-size, which lens opening is normally used as a basis for the detail exposure?
1. F/16
2. F/22
3. F/45
4. F/90

7-6. Which exposure of the multiple exposures increases the density of the dots in the shadow areas?
1. Flash
2. Middletone
3. Highlight
4. Detail

7-7. Which procedure does the cameraman follow when he makes the flash exposure?
1. He takes the shot of a sheet of white paper placed over the copy
2. He takes a short duration exposure at a large aperture setting
3. He shines a light directly into the camera through the lens
4. He does either 1 or 3 above

7-8. Circular glass halftone screens differ from rectangular screens in that they
1. are used primarily for single-color work
2. are used most often for color-separation work
3. have a finer screen ruling
4. have a coarser screen ruling

7-9. In color separation work, the cameraman causes some dots to print side by side and other dots to overlap by
1. using various screens having different numbers of rulings
2. changing the angle of the screen rulings in relationship to the camera
3. changing from one color of screen to another color of screen
4. doing any of the above

In items 7-10 through 7-13, select from column B the screen angle for the negative color in column A.

	A. Color	B. Screen angle
7-10.	Yellow	1. 45
7-11.	Blue	2. 75
7-12.	Black	3. 90
7-13.	Red	4. 105

Learning Objective: Compare the contact screen with the glass halftone screen, identify types of contact screens, and describe steps in using the contact screen to include screen positioning, lens opening, and making the exposure.

7-14. Contact screens provide a better rendition of tone than that provided by glass screens in halftoning because
1. the dots are of various sizes
2. the screen distance is more variable
3. the dots create a smoother optical illusion
4. contact screens have a greater range of standard rulings per inch

7-15. Contact screens are more fragile than glass halftone screens.

In items 7-16 through 7-18, select from column B the contact screen that is used for the purpose in column A.

A. Purposes	B. Contact screens
7-16. To produce halftone positives from continuous-tone negatives in color-separation work	1. Magenta
7-17. To produce color-separation negatives from colored copy	2. Negative magenta
7-18. To produce halftone negatives	3. Gray
	4. Positive magenta

7-19. Which filter, if any, should you use with the screen if the copy is extremely flat?
1. None
2. Magenta
3. Yellow
4. Blue

7-20. What relationship of film emulsion and contact screen emulsion should you use when you position the screen in the camera?
1. Emulsion of the film to the emulsion of the screen
2. Emulsions of the screen and the film face the vacuum back
3. Emulsion of the film faces the vacuum back and emulsion of the screen faces the lens
4. Emulsions of both the film and the screen face the lens

7-21. You may control the contrast when you are using a contact screen by any of the following methods except by
1. using filters
2. varying the agitation during development
3. using a bump exposure
4. varying the lens opening for the detail exposure and the flash exposure

7-22. Which color of light is used to produce the smallest and hardest possible dot formation for the flash exposure?
1. White
2. Red
3. Blue
4. Yellow

7-23. For what reason does the series OA filter require almost double the exposure time of the series 00 filter for the flash?
1. More wattage is required for the series OA filter
2. Less light is transmitted by the series OA filter
3. The series OA filter is placed further from the camera
4. The light from the series OA filter falls on only part of the film

---

Learning Objective: Determine the method of finding the screen range of a magenta screen and the density range of copy.

7-24. Assume that you have developed the negative of your same-size halftone shot of a gray scale. Which two steps do you locate on the negative to determine the density of the screen?
1. 90 percent shadow dot and 10 percent shadow dot
2. 80 percent highlight dot and 20 percent shadow dot
3. 90 percent highlight dot and 10 percent shadow dot
4. 80 percent shadow dot and 10 percent highlight dot

7-25. Assume that the highlight step has a density reading of 0.21 on the gray scale and the shadow step has density reading of 1.42 on the gray scale. What is the density range of the screen?
1. 0.21
2. 1.21
3. 1.42
4. 1.63

7-26. Which area of a negative will print as the smallest black solids when the job is printed?
1. 90 percent highlight
2. 80 percent highlight
3. 20 percent shadow dot
4. 10 percent shadow dot

7-27. During the printing of a job, which of the following factors affect the size of dots in the highlight and shadow areas?
1. The printing pressure
2. The type of paper stock
3. The type of ink
4. All of the above

7-28. By which method do you find the density range of your copy after you select the proper areas of the copy?
1. Subtract the density reading of the shadow area from the density reading of the highlight area
2. Subtract the density reading of the highlight area from the density reading of the shadow area
3. Add the density readings of the highlight area and the shadow area
4. Take the average density reading of the highlight and the shadow area

7-29. What exposure technique is necessary when the density range of the copy is less than the density range of the screen?
1. A single exposure with no flash
2. A basic exposure with a flash
3. A basic exposure with a bump exposure
4. A basic exposure, bump exposure, and flash exposure

Learning Objective: Describe the procedures for determining the exposure times for producing a halftone negative.

7-30. When you are using a contact screen, for which exposures must you establish a basic time in determining the exposures to produce a halftone negative?
1. Main and highlight
2. Highlight and flash
3. Flash and main
4. Main, flash, and highlight

7-31. Which condition do you seek when you make your trial exposures to determine the basic main exposure?
1. An exposure time that puts 90 percent highlight dot in step number 1 on the gray scale
2. An exposure time that puts 80 percent highlight dot in step number 1 on the gray scale
3. An exposure time that puts 90 percent highlight dot in step number 2 on the gray scale
4. An exposure time that puts 80 percent highlight dot in step number 2 on the gray scale

7-32. You are preparing a table similar to the one shown in figure 8-19 of your textbook. Assume that, for a same-size shot, by trial and error you determine a basic exposure time of 20 seconds with a lens aperture of f/16. What is the exposure time necessary to put 90 percent dot in the highlight density step marked 0.10?
1. 16 seconds
2. 22 seconds
3. 25 seconds
4. 27 seconds

7-33. Which of the following factors will cause variation in the exposure time of the table you compute for the basic main exposure?
1. Making an enlargement
2. Using an aperture other than F/16
3. Making a reduction
4. Doing any of the above

7-34. What condition do you seek when you determine the time for the basic flash exposure?
1. A 10 percent black dot when the film is given a flash after the main exposure
2. A 10 percent black dot when the film is given a flash without a main exposure
3. A 90 percent black dot when the film is given a flash after the main exposure
4. A 90 percent black dot when the film is given a flash without a main exposure

7-35. Assume that you have taken a series of stepped exposures to determine your basic flash exposure and that 40 seconds produces the desired results. In computing a chart of flash exposure time such as the one shown in figure 8-20 of your textbook, what time should you enter in column two for 80 percent of the basic exposure?
1. 24 seconds
2. 28 seconds
3. 32 seconds
4. 36 seconds

7-36. To use the flash exposure chart you must know (A) the density range of the screen, (B) the excess density range, and (C) the density range of the copy to be shot. How should you use these factors for the chart?
1. Subtract A from C and locate B on the base line of the chart
2. Subtract C from A and locate B on the base line of the chart
3. Add A and B and locate C on the base line of the chart
4. Add A and C and locate B on the base line of the chart

7-37. For which condition should you consider using a bump exposure in shooting a halftone negative?
1. Screen density range of 1.45 and copy density range of 1.66
2. Screen density range of 1.35 and copy density range of 1.45
3. Screen density range of 1.25 and copy density range of 1.25
4. Screen density range of 1.15 and copy density range of 0.90

7-38. The bump exposure is made without the halftone screen positioned over the film.

7-39. Reproducing both ends of the photographic scale is difficult because if you shoot for the highlights you
________(A)________ the screen range and
lengthen, compress
if you shoot for shadow details you
________(B)________ the screen range.
lengthen, compress
1. (A) compress, (B) compress
2. (A) compress, (B) lengthen
3. (A) lengthen, (B) compress
4. (A) lengthen, (B) lengthen

7-40. For cameramen who check the position of the gray scale step with the 50 percent dot, the placement of the 50 percent dot depends on
1. the paper stock
2. the copy
3. whether the highlights or the shadows are to be stressed
4. all of the above

Learning Objective: Recognize uses of the Kodak Halftone Negative Computer and automatic exposure computers.

7-41. The Kodak Halftone Negative Computer can be used to determine
1. bump exposure
2. main exposure
3. flash exposure
4. any of the above

7-42. What camera settings should you make to produce the test negative for calibrating the Kodak computer?
1. Set for a reduction shot with a lens aperture two stops from the smallest lens opening
2. Set for an enlargement shot with a lens aperture two stops from the largest lens opening
3. Set for a same-size shot with a lens aperture two stops from the largest lens opening
4. Set for a same-size shot with a lens aperture two stops from the smallest lens opening

7-43. After you calibrate the computer shown in figure 8-27 and prepare it for use with a particular copy, you obtain the main exposure time by looking at
1. scale H
2. window G
3. scale A
4. scale C

7-44. Some automatic exposure computers automatically accomplish all of the following computations except the

1. bump exposure time for the copy
2. main exposure time for a copy
3. flash exposure time for a copy
4. density range of the screen

Learning Objective: Determine principles involved in developing halftone negatives.

7-45. What is the recommended temperature of the developer for processing halftone negatives?

1. 62° F
2. 66° F
3. 68° F
4. 72° F

7-46. The loss of strength in the developer has more affect on the shadow areas of the halftone negative than on the highlight areas.

7-47. What is the average developing time for the halftone negative?

1. 2 to 2 1/2 min
2. 2 1/4 to 2 3/4 min
3. 2 1/2 to 2 3/4 min
4. 2 to 3 min

7-48. What result will you get if you rapidly agitate the developer while you process a halftone negative?

1. Larger shadow dots and less contrast
2. Smaller shadow dots and greater contrast
3. Smaller highlight dots and less contrast
4. Larger highlight dots and greater contrast

7-49. Which type of agitation should you use to reduce the overall contrast and bring out extremely fine detail in the halftone negative?

1. Agitate the developer for the first few seconds and stop during the last minute
2. Agitate the developer rapidly during the development
3. Agitate the developer gently during the development
4. Allow the developer to remain still during the first period of development and rapidly agitate the developer during the last minute

7-50. If you are developing a halftone negative by inspection, you can stop the developing action more abruptly with fresh water than with an acetic acid solution.

7-51. You are developing by inspection. You should check the negative for

1. the presence of 10 percent pinpoint dots in the shadow areas
2. small, round openings formed by the joining together of the highlight dots
3. middletone dots that are square
4. all of the above

7-52. Your inspection indicates that the negative is too contrasty. How may you correct this in your next exposure of the copy?

1. Reduce the main exposure to increase the size of the shadow dots and adjust the flash to regulate the size of the highlight dots
2. Reduce the main exposure to regulate the size of the highlight dots and adjust the flash to increase the size of the shadow dots
3. Decrease the size of the shadow dots by adjusting the flash and regulate the size of the highlight dots by increasing the main exposure
4. Increase the main exposure to regulate the size of the shadow dots and adjust the flash to decrease the size of the highlight dots

---

Learning Objective: Recognize characteristics and uses of gray, elliptical, round dots, respi, and special-effect contact screens, and the methods of dropping out whites.

7-53. Why are gray contact screens more difficult to use than magenta contact screens?

1. They have a shorter tonal range and are more contrasty
2. They require more exposure time
3. They are less contrasty and have a longer tonal range
4. They are more fragile and require greater handling care

7-54. When you use a gray contact screen to make a direct color separation negative, you can increase the contrast by placing
1. a yellow filter over the camera lens
2. the screen in the camera so that the emulsion faces the lens
3. a blue filter over the camera lens
4. the emulsion side of the screen against the film emulsion

7-55. The elliptical gray contact screen is more advantageous than the regular gray contact screen in that the former screen
1. minimizes grain when the original copy is grainy
2. produces halftones which fill in less readily on the press
3. produces a more subtle transition from highlights to shadows
4. does all of the above

7-56. Which of the following screens is the most contrasty?
1. Square dot negative magenta screen
2. Square dot gray screen
3. Round dot magenta screen
4. Square dot positive magenta screen

7-57. Which screen should you use for retention of detail for a halftone that is to be printed on poor quality paper?
1. Square dot magenta screen
2. Respi contact screen
3. Square dot gray screen
4. Round dot screen

7-58. In what respect, if any, does the special-effect screen differ from the regular gray contact screen?
1. The special-effect screen is darker in contrast
2. There is no difference
3. The special-effect screen is lighter in contrast
4. The special-effect screen is less transparent

7-59. Which of the special-effect patterns produces a stippled image?
1. Mezzotint
2. Etching
3. Circle
4. Wavy line

7-60. By which of the following methods can you obtain dropouts?
1. Prepare an acetate overlap with chinese white
2. Paint out sections of the negative
3. Use black ink to prepare an acetate overlay
4. Use any of the above methods

Learning Objective: Recognize techniques involved in color separation and combination work.

7-61. Before he takes each shot in making a set of color separation negatives, the cameraman must change the
1. angle of the screen
2. arrangement of the lamps
3. opening of the lens
4. length of the exposure

7-62. Which filter should the cameraman use to separate the blue color in the original copy?
1. Yellow
2. Green
3. Red
4. Blue

7-63. In the indirect method of color-separation work, the first step includes the production of a continuous tone negative for each color. What is the second step?
1. Printing the negatives on press plates
2. Making continuous tone positives from the negatives
3. Rephotographing the negatives through a halftone screen
4. Staining or reducing the negatives to obtain proper highlights and densities

7-64. Masking is used in halftone color separation work to
1. cut down on the amount of handwork involved in separating the colors
2. restore the original colors when the plates are run on the press
3. keep the halftone dots of one negative from overlapping those of another
4. provide a means of comparing the density of the process color negatives

7-65. What effect, if any, results when a line drawing is photographed through a screen?
1. None
2. The lines drop out
3. The lines appear soft and feathery
4. The lines are sharp and clear

7-66. You have been asked to shoot copy consisting of black lines overlapping the tone areas. You are to make two negatives to be overprinted on the press plate. Your first step in this job requires the preparation of
1. copy in 2 different colors
2. a film positive from the line negative
3. the line copy on illustration board and the tone copy on an acetate overlay
4. the tone copy on illustration board and the line copy on an acetate overlay

7-67. Which method of combination work is effective only if the line copy is to be printed in black over the halftone area?
1. Splicing negatives
2. Reverse lettering
3. Surprinting
4. Masking

7-68. Figure 7A shows steps in the preparation of
1. copy at a tilt on the copyboard for rescreening halftones
2. an acetate shading sheet for tinting a line negative
3. line and tone masks for combination shots
4. acetate overlays for color separation shots

7-69. What advantage does the process shown in figure 7A have over surprinting?
1. The moire is eliminated
2. Splicing is unnecessary
3. Negative corrections are more easily made
4. Only one exposure is necessary

7-70. For what purpose would you use an acetate shading sheet to cover the transparent area of a line negative?
1. To supply tint to the area
2. To mask the area for a halftone shot
3. To indicate, to the stripper, that the negative is to be spliced
4. To provide a background for reverse lettering

Learning Objective: Recognize procedures of copying a clipping and the care of the contact screen.

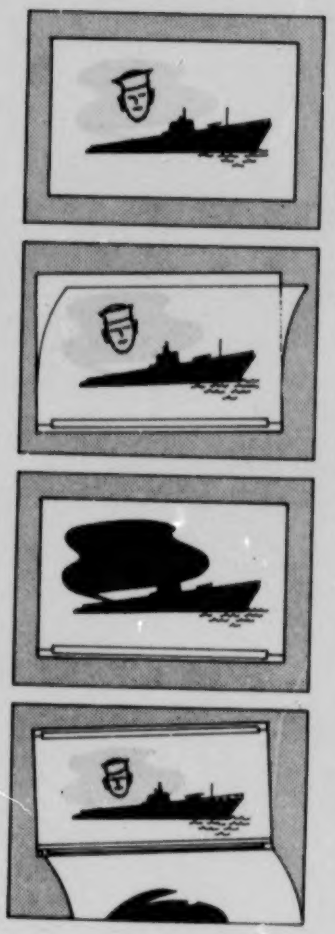


Figure 7A. --Combination line and tone copy.

7-71. On halftone jobs, some cameramen work with continuous-tone positives when enlarging and reducing. Why is screening postponed until the final negatives are prepared?
1. Enlarging or reducing halftone positives affects the number of dots
2. Enlarging or reducing halftone positives affects the size of the dot
3. Halftone positives cannot be enlarged or reduced
4. Halftone positives cannot be made in the vacuum printing frame or by projection with an enlarger

7-72. To make a satisfactory copy of a magazine halftone clipping produced by a 120-line screen, you may use any of the following methods except
1. making a same-size line shot
2. using a diffuser filter over the camera lens
3. tilting the copy 30° off vertical
4. reducing the size of the magazine halftone

7-73. Stubborn spots on a contact screen should be removed with a
1. piece of saturated cotton
2. camel's hair brush
3. piece of photo chamois
4. Staticmaster brush

7-74. Which condition possibly creates the worst problem in the handling of a contact screen?
1. Waterspots
2. Dust
3. Half-moon creases
4. Fingerprints

Assignment 8

The Halftone Negative (continued); Negative Corrections and Stripping

Textbook NAVEDTRA 10452-C: Pages 210-245

Learning Objective: Recognize the composition of and the techniques in using Kodalith Autoscreen Film, the method of screening polaroid prints, and principles of photoelectric scanners.

8-1. Which characteristic of the Kodalith Autoscreen Film eliminates the need of a halftone screen?
1. The built-in screen element of the film
2. Variations in the thickness of the emulsion layer
3. The blending of different types of material to produce the emulsion
4. The composition of many light-sensitive areas in the emulsion

8-2. The exposures for producing halftones with autoscreen film are reduced because of the absence of a separate screen.

8-3. Assume that you are making a trial exposure on Kodalith Autoscreen Film and are using two No. 2 photoflood lamps. Which combination of lamp distance, exposure time, and lens opening should you use for the detail exposure?
1. 2 feet from copyboard, 25 seconds, F/16
2. 2 feet from copyboard, 30 seconds, F/22
3. 3 feet from copyboard, 30 seconds, F/22
4. 3 feet from copyboard, 25 seconds, F/32

8-4. The halftone screen used with the 4" X 5" Polaroid camera is held in place by
1. spring clips
2. masking tape
3. vacuum pressure
4. magnets

8-5. The first Scan-A-Graver made impressions on a plastic or metal plate by means of
1. heated electric needle
2. cold stylus
3. stamping stylus
4. etching stylus

Learning Objective: Analyze some causes and remedies for halftone negative difficulties.

8-6. Which condition causes a halftone negative to develop too slowly?
1. Incorrect focusing
2. Insufficient exposure
3. Dusty screen
4. Hot developer

8-7. Which of the following difficulties of halftone negatives may you correct by cooling the developer to the recommended temperature?
1. Slow development of image
2. Insufficient contrast
3. Too much contrast
4. Hot spots on negative

8-8. Which remedy may you use to correct a halftone negative that lacks contrast?
1. Increase the length of time for the main exposure
2. Decrease the length of time for the main exposure
3. Decrease the temperature of the developer
4. Increase the length of time for the flash exposure

8-9. Blotches on a halftone negative may be caused by the
1. bellows allowing light to leak in
2. screen making improper contact with the film
3. lack of uniform illumination
4. underdevelopment of the negative

8-10. Which condition occurs when the halftone film is dusty?
1. Elongated halftone dots
2. Blurred image
3. Foggy negative
4. Pinholes in the negative

8-11. For which condition of the negative may you have to repair the camera bellows?
1. Oblong or fuzzy dots
2. Thinness in corners
3. Flares or hot spots
4. Blurred image

Learning Objective: Recognize the equipment and procedures used to prepare and correct film that is used in making lithographic plates.

8-12. The process of assembling negatives and attaching them to the layout sheet is called
1. fixing
2. stripping
3. step-and-repeat
4. gumming the plate

8-13. The colored paper used for stripping acts as a support for the negative and as a
1. guide for any necessary opaquing
2. straight edge for engraving
3. mask for the non-image areas
4. guide for ruling a series of lines

8-14. The guide lines on the goldenrod are used in the stripping procedure to accurately
1. position the film
2. line up the offset printing plates
3. expose the plate through the negatives
4. cut the film to fill the opening in the paper

8-15. Which of the following procedures may be accomplished by the use of a light table?
1. Making corrections on the film
2. Laying out the work
3. Stripping in the film
4. Doing any of the above

8-16. A negative assembly that is ready for printing is called a
1. film positive
2. flat
3. plate
4. run up

8-17. The process in which a lightproof paint is applied to a negative to make repair and corrections is called
1. fixing
2. intensifying
3. opaquing
4. highlighting

8-18. At what point in the procedure for making a flat is the opaque generally used to correct the negatives?
1. Before the negative is mounted on the goldenrod
2. Before the goldenrod is masked
3. After the negatives are mounted and the windows are cut
4. Before the edges of the negative are cropped

8-19. The proper procedure for applying a second coat of liquid opaque to a negative is to use
1. a mix that is thinner than the first coat
2. the same mix, but apply it to the reverse side of the negative
3. the same mix, but apply it directly over the first coat
4. a mix that is thicker than the first and apply it directly over the first coat

8-20. Which of the following methods may be used to crop halftones?
1. Masking with goldenrod
2. Opaquing
3. Using strips of red or black tape
4. Using any of the above

8-21. What methods do you use to correct defects in negatives that result from (A) shadows and (B) reflections?
1. (A) scrape from the surface of the negative, (B) mask out or cover with opaque
2. (A) mask out or cover with opaque, (B) scrape from the surface of the negative
3. Both (A) and (B), scrape from the surface of the negative
4. Both (A) and (B), mask out or cover with opaque

8-22. The quality of the lines produced upon the negative by an engraving tool will depend on the
1. angle at which the tool is held
2. amount of pressure applied while making the cut
3. sharpness of the tool being used
4. all of the above

8-23. In the preparation of a negative for stripping, what should be the minimum width of the margin left around the image on the negative?
1. 1/8 in.
2. 3/8 in.
3. 1/2 in.
4. 3/4 in.

8-24. When you are planning a layout, the decision as to whether to run a job more than one-up on a press depends on
1. the size of the press that is available
2. the length of the run
3. the overall size of the job
4. all of the above considerations

8-25. Where is the best place to position large solids and halftones on your layout?
1. In the center and along the gripper
2. At the top and along the gripper
3. At the left and along the gripper
4. In the center and at the top

8-26. Which of the following devices do you use to align the goldenrod paper with the layout table?
1. Calipers
2. T-square
3. Gripper
4. Protractor

8-27. How large a sheet of goldenrod paper should be used for planning a layout?
1. Larger than the press plate to be used
2. Smaller than the press plate to be used
3. The same size as the press plate to be used
4. Large enough to accomodate the negatives to be run, but smaller than the press plate to be used

8-28. The recommended method of marking dimensions with points is to
1. underline them
2. circle them
3. mark them with a soft pencil
4. mark them with a hard pencil

8-29. The amount of space that you must allow for the cylinder clamp margin is determined by the
1. size of the layout
2. press used to run the job
3. type of job being run
4. placement of the negatives

8-30. Negatives which are to be positioned in place on a flat are squared up by reference to the
1. gripper edge
2. gripper margin
3. paper edge
4. center marks

Information for items 8-31 through 8-33: LI3 Neal is instructed to layout a flat for a standard naval letterhead with seal. He will run the job on a 10" x 15 Multilith press, and will use 8" x 10 1/2" stock.

8-31. Neal uses the straightedge attached to the layout table to align the goldenrod paper. After he fastens the paper with clamps, how should he label the goldenrod?
1. Lower edge "straightedge", right edge "gripper"
2. Upper edge "straightedge", right edge "gripper"
3. Lower edge "straightedge", left edge "gripper"
4. Upper edge "straightedge", left edge "gripper"

8-32. Neal will measure down from the "straightedge" side of the paper at intervals of 1", 5", and 9". He will mark the paper at each of these intervals with a ball point pen. What does the line at the 5" mark represent?
1. The centerline of the letterhead
2. The right edge of the seal
3. The left edge of the seal
4. The bottom line of the letterhead

8-33. After he has attached the negatives to the goldenrod, Neal's next step is to
1. opaque the image areas
2. cut openings in the goldenrod for image areas
3. scratch the center of the negative on the emulsion side
4. attach the flat to a larger piece of goldenrod

8-34. Which of the following will result if the sheet detector of the offset press fails to operate when a sheet fails to come through?
1. The press will stop operating
2. The blanket will deposit ink on the cylinder
3. The press will jam
4. The feedboard will drop

8-35. What is one advantage of placing negatives under the goldenrod, cutting the windows, and attaching the negatives along the edges of the windows?
1. There is less chance of cutting the negatives
2. Better contact between the film and the plate is provided
3. The stripper can attach the negatives from the emulsion side
4. It is not necessary to fold back the goldenrod to position the negatives

---

Learning Objective: Determine the imposition methods used in bookwork.

8-36. Which of the following would prevent you from making a "gang" layout?
1. A number of unrelated jobs
2. Jobs of different sizes
3. Jobs cannot be cut out of the press sheet properly
4. One of the jobs has to be run two up

8-37. For which of the following jobs must allowance be made for double trimming?
1. Illustrations that do not bleed
2. Negatives that bleed along the gripper margin
3. Gang layouts with bleeding illustrations
4. All of the above

8-38. Which of the following devices is used to determine the order in which pages are to be placed on the goldenrod layout?
1. Binder's goldenrod layout
2. Imposition chart
3. Four-page layout
4. Combination layout

8-39. Which of the following steps will have to be taken if the stripper attaches the negatives to the top of the goldenrod?
1. The flat must be turned over when the plate is exposed
2. The window areas will have to be cut prior to attaching the negatives
3. The windows for the image areas will be cut from the top of the goldenrod
4. The negative will have to be attached with the emulsion side down

8-40. How should the pages of the flat be numbered in relation to the imposition chart if the negatives are stripped to the top of the goldenrod?
1. The same
2. Reversed from top to bottom
3. Reversed from left to right
4. Reversed from top to bottom and from left to right

8-41. One of the main differences in back-up type of imposition and other imposition methods is that in the back-up method the
1. negatives for both the front and back of pages are prepared on the same flat
2. layouts for the front and back of pages are prepared on separate flats
3. layout sheet is flopped over, top to bottom, instead of left to right
4. layout sheet is turned right to left instead of flopped over top to bottom

8-42. You indicate on the imposition chart which edge of the sheet is to be fed into the rollers of the folding machine by marking the charts with
1. an "x"
2. a series of "x"s
3. a triangular notch
4. a round notch

8-43. After printing, a job for a book was folded on the horizontal centerline and trimmed on the vertical centerline. Where did the lithographer locate the heads of the pages in his layout?
1. Toward the horizontal centerline
2. Away from the vertical centerline
3. Toward the vertical centerline
4. Away from the horizontal centerline

8-44. What do the diamond-shaped notches in an imposition chart represent?
1. The gripper edge
2. The guide edge
3. A double trim allowance
4. A single trim allowance

8-45. The main difference between work-and-turn and work-and-flop impositions is in the
1. size of the type used
2. width of the gripper margin
3. speed of the press sheet reversal
4. manner in which the layouts are reversed

8-46. Which of the following should be used as reference points for all measurements when you strip for bookwork?
1. Gripper margin lines
2. Crease line
3. Press sheet outline
4. Centerlines

8-47. Which of the following will compensate for the tendency of a signature's pages to push out?
1. Allowing more margin on the gutter side and along the outside edge of the page
2. Allowing more margin on the gutter side and less margin along the outside edge of the page
3. Allowing less margin on the gutter side and along the outside edge of the page
4. Allowing less margin on the gutter side and more margin along the outside edge of the page

8-48. What is the purpose of placing "tick" marks in the trim margins of the press block?
1. They mark the trim line for the binderyman
2. They serve as landmarks for measuring for the placement of negatives
3. They are used as fold guides by the binderyman
4. They indicate the amount of space between the trim line and the margin of the text

8-49. How should the windows of the goldenrod be cut if you are bleeding illustrations?
1. 1/8" short of the trim line
2. 1/8" beyond the trim line
3. 1/4" short of the trim line
4. 1/4" beyond the trim line

8-50. All of the following statements pertaining to bookwork are correct except
1. illustrations that will appear on facing pages must be stripped on the same flat
2. the windows for an illustration that will bleed into the gutter should be cut exactly on the centerline of the fold
3. double trims are required when bleed work is used with gang layouts
4. the pages may be cut to the final trim after the book is assembled

8-51. When you strip inserts into a negative, you should attach the negative to a
1. sheet of goldenrod
2. piece of clear glass
3. sheet of black paper
4. metal straightedge

Learning Objective: Recognize the methods used in obtaining registration and for preparing color flats.

8-52. In the double printing process, the two negatives to be exposed successively on the plate in exact registration are stripped in on two separate
1. glass plates
2. goldenrod flats
3. acetate sheets
4. line negatives

8-53. Which of the following devices is used to align the key flat with the second flat when pin point film register marks are used?
1. Magnifying glass
2. Calipers
3. Straightedge
4. Vacuum frame

In items 8-54 through 8-57, select from column B the registration methods that are described in column A.

	A. Descriptions	B. Methods
8-54.	Difficult for the platemaker to use	1. Butterflies
8-55.	Drawn with a pencil or printed on the plate	2. Tick marks
8-56.	Used with large flats where close registration is needed	3. Tab and pin
8-57.	Crossed lines on small pieces of film	4. Film register marks

---

8-58. The purpose of the tab and pin system that is used in preparing flats is to
1. aid in splicing negatives together
2. indicate the trim margins
3. aid in preparing imposition charts
4. obtain close registration

8-59. Which of the following procedures is used in the flap method of double printing on film without the use of a vacuum frame?
1. Place the film on top of both flaps; expose the top film and remove it before exposing the bottom file
2. Place the film on the bottom and expose the bottom flap; then fold the top flap over the bottom and expose the two flaps at the same time
3. Place the film between the two flaps and make the first exposure; remove the top flap, slip the film under the bottom flap and make the second exposure
4. Place the film on the top of the bottom flap and make the first exposure; then fold the top flap over and expose the film again

8-60. A film positive of the line negative is necessary for
1. reverse lettering
2. surprinting
3. inserting
4. step-and-repeat work

8-61. A film positive stripped over a halftone negative to produce certain special effects must always be larger than the negative in order to
1. allow the halftone dots to spread
2. create a shadow for registration
3. press the negative and plate together
4. eliminate any shadow or edge

8-62. When processing a job requiring two colors, which angle of tint should you use for your strongest color?
1. 15 degrees
2. 45 degrees
3. 75 degrees
4. 90 degrees

Information for items 8-62 through 8-66: You are running a job with four colors. Select the color from column B that relates to the angle under column A.

	A. Degree Angle	B. Color
8-63.	15 degree angle	1. Yellow
8-64.	45 degree angle	2. Blue
8-65.	75 degree angle	3. Red
8-66.	90 degree angle	4. Black

8-67. Cameraman Brown covers the plate with goldenrod paper, cuts a window in the lower left hand corner, and prints a negative through this window. He then cuts a window in the lower right hand corner, covers the rest of the plate, and shoots the negative again through the new window. This process is called
1. work-and-turn
2. step-and-repeat
3. reverse lettering
4. double printing

8-68. What method of step-and-repeat work is being used if the platemaker, after making his first exposure, moves the flat from the gripper toward the trailing edge of the plate for the second exposure?
1. Step-over
2. Double burn
3. Step-up
4. Surprinting

8-69. Close registration requirements, such as in color register work, are sometimes difficult to maintain because of the
1. necessity to prepare several flats
2. need to use a special light table
3. influence of weather conditions on the paper
4. great detail in the negatives

8-70. For close register work cameraman Brown uses the method generally used in process work. He strips the flat for the main color. The platemaker then prints the required number of master copies on separate sheets of glass or acetate which have been covered with a
1. blueprint solution
2. goldenrod sheet
3. gelatin solution
4. coat of red opaque

8-71. Masking is not required when you are preparing flats for
1. step-and-repeat work
2. surprinting
3. reverse lettering
4. film positive work

8-72. A diazo machine produces
1. negatives from negatives
2. positives from positives
3. positives from negatives and negatives from positives
4. all of the above

Assignment 9

Platemaking; The Offset Press

Textbook NAVEDTRA 10452-C: Pages 246-287

Learning Objective: Recognize the types and characteristics of the plates that are used in lithography.

9-1. What are the three basic categories of plates used in lithography?
1. Metal, plastic, fused
2. Light-sensitive, contact, electrostatic
3. Surface, deep-etched, relief
4. Emulsion, photopolymer, electrostatic

9-2. What base material is used in making the presensitized plate?
1. Grained aluminum, zinc, or stainless steel
2. Polyethylene coated paper
3. Aluminum foil or plastic-coated paper
4. Plastic or aluminum with little grain or no grain

9-3. What procedure does a platemaker use to produce a positive working plate from a presensitized plate?
1. Exposing, developing, fixing, lacquering
2. Exposing, developing, lacquering
3. Exposing, lacquering, developing
4. Exposing, applying wipe-on solution, regraining

9-4. Which of the following coatings is present on the presensitized plates that are most often used aboard ship?
1. Photopolymer
2. Diazo
3. Zinc oxide
4. Albumin

9-5. One of the differences between the preparation of presensitized and wipe-on plates is that in the wipe-on plates the
1. plate is ready for use immediately
2. plate must be regrained
3. lacquer emulsion is never applied
4. coating must be applied by the platemaker

9-6. Which of the following coatings may you use for wipe-on plates?
1. Albumin solution
2. Casein solution
3. Diazo solution
4. All of the above

9-7. By which of the following methods may your prepare a wipe-on plate?
1. Flowing the coating solution over the plate
2. Wiping the coating over the plate with a swab or cheesecloth or specially-treated cotton
3. Passing the plate between rollers which are revolving in a tray of coating solution
4. By any of the above methods

9-8. What electrical action occurs when you press the charge button of the processor to charge an electrostatic plate?
1. Stationary discharge wires create a negative electrical charge in the plate coating
2. Moving discharge wires pass across the plate and create a negative electrical charge in the coating
3. A positive electrical charge is created in the coating as the discharge wires pass over the plate
4. A positive electrical charge is created in the coating as the plate passes under the stationary discharge wires at the front of the processor

9-9. What changes occur in the electrostatic plate when it is exposed?
1. The non-image areas of the plate are given a positive charge
2. The positive charge is neutralized in the non-image areas of the plate
3. The image areas of the plate are given a negative charge
4. The positive charge is neutralized in the image areas of the plate

9-10. What is the purpose of the toner in a machine that is used to process electrostatic plates?
1. To cover the non-image area on the plate
2. To form a barrier coating on the plate
3. To form the reproduced image on the plate
4. To make the plate resistant to solvents, acids, and gums

9-11. How should you clean the electrostatic plate after use?
1. Apply developer, press the transfer button, and slowly feed the plate into the processor
2. Remove the image by rubbing the plate with a piece of cotton
3. Sprinkle with toner, press the charge button, and slowly feed the plate into the processor
4. Remove the image by rinsing the plate in running water

9-12. What procedure should you use to develop the plate in the diffusion transfer process?
1. Place the negative against the plate and feed both into the same slot of the developing machine
2. Feed the negative and the plate into separate slots of the developing machine
3. Pour the developer onto the coating of the plate and place the negative against the plate and the developer
4. Cover the negative with developer and press the plate coated side down against the negative

9-13. The developer for the plate that is used in the Itek Platemaster is contained in the
1. activator solution in which the plate is placed after exposure
2. bottom layer of the polyethylene emulsion that covers the plate
3. top layer of the polyethylene layer that covers the plate
4. silver salts solution that is applied to the surface of the plate

9-14. When the developer is released, the non-image areas of a photo-direct plate produced by the Itek Platemaster is caused to become
1. ink receptive
2. moisture receptive
3. finely grained
4. dissolved and removed from the surface

9-15. The cameraman develops his Kodak photo resist plates by
1. flowing the plates with solvent in a whirler
2. rubbing the plates with water-soaked cotton
3. feeding negatives and plates into a machine where they pass through developing solution and are pressed together by rollers
4. spinning the plates which are clipped into a developing tray, so that developing powder cascades over the surfaces of the plates

---

In items 9-16 through 9-19, select from column B the plates that use the base materials described in column A.

	A. Material	B. Plates
9-16.	Polyethylene-coated paper	1. Direct-image
		2. Camera direct
9-17.	Photopolymer coated zinc or aluminum	3. Kodak photo resist
		4. Deep-etch
9-18.	Grained aluminum or stainless steel	
9-19.	Plastic-coated paper or aluminum	

9-20. Which coating substance is applied to the deep-etch plate?
1. Casein and ammonium bichromate solution
2. Organic plastic solution
3. Gum arabic and ammonium bichromate solution
4. Egg white and ammonium bichromate solution

9-21. Which of the following metals used in making lithographic plates is receptive to ink but not to water?
1. Chromium
2. Copper
3. Aluminum
4. Stainless steel

In items 9-22 through 9-24, select from column B the agent that is used in the developing process of the plate in column A.

	A. Plate		B. Agent
9-22.	Multimetal plate	1.	Sodium hydroxide solution
9-23.	Electrostatic plate	2.	Developing powder
9-24.	Dry offset plate	3.	Deep-etch developer
		4.	Ink and water

9-25. When you use a relief plate on a conventional letterpress, what adjustment, in addition to the bearers between the plate cylinder and the blanket cylinder, must you make on the press?

1. Disengage the ink rollers
2. Tighten the pressure rollers
3. Disengage the water rollers
4. Tighten the gripper edge adjustment

Learning Objective: Determine the procedure used to process presensitized plates.

9-26. One of the differences between the conventional zinc or aluminum plates and the presensitized plates is that the presensitized plates

1. have a thinner metal base
2. are less sensitive to light
3. have an indefinite shelf life
4. have a thicker metal base

9-27. The only light bulbs available are regular bulbs. To protect the sensitive coating on the plates, you should cover the regular bulbs with

1. goldenrod paper
2. black paper
3. aluminum foil
4. blue tissue paper

9-28. The gray scale that you printed on the plate showed 3 as the highest completely solid step when you developed the plate. What did this indicate?

1. The plate was underexposed
2. The exposure was just about right
3. The arc lamp was turned on too soon
4. The plate was overexposed

9-29. In order to increase your gray scale reading by 2 steps for an underexposed plate, you must increase the exposure time by

1. 25 percent
2. 50 percent
3. 75 percent
4. 100 percent

9-30. When you have a plate that is coated on both sides, what procedure is recommended to avoid damaging the unexposed side during the developing process?

1. Wash the unexposed side with sodium hydroxide solution
2. Use goldenrod to prevent exposing the unused side
3. Overexpose the plate
4. Expose and develop both sides of the plate

9-31. After developing the plate, for what reason would you also cover the image with asphaltum?

1. To lengthen the life of the plate
2. To protect the image from fingerprints
3. To preserve the plate until it is used several days later
4. To check the plate for defects

9-32. The 3M Company subtractive plate differs from the positive-working plate in that during development of the subtractive plate, the lacquer is

1. added to the image area
2. removed from the image area
3. removed from the nonimage area
4. added to the nonimage area

9-33. The advantage of the machine processors, such as the MR-440, to develop plates as compared to developing a plate by hand is that the machine provides

1. faster development
2. greater economy
3. both 1 and 2 above
4. more accurate development

Learning Objective: Determine the operation, processing procedure, and maintenance of the 3M Camera Processor.

9-34. What is the coating of the 3M Camera-Processor plate?

1. Selenium and silver-halide
2. Silver-halide and zinc oxide
3. Silicone and ammonium bichromate
4. Silver-halide and silicone

9-35. What is the largest plate that can be produced with the 3M?
1. 10" x 11"
2. 10" x 15"
3. 12" x 24"
4. 24" x 36"

9-36. Which camera component bends the copy image 90 degrees and causes it to read forward on the plate?
1. Double concave lenses
2. Prism
3. Mirrors
4. Double convex lenses

9-37. How can you determine that the roll of plate material is almost empty?
1. By checking the counter inside the small door at the back of the magazine
2. By the sound of a buzzer
3. By checking the plate counter on the control panel
4. By checking the plate length dial on the control panel

9-38. Proper focusing of the 3M Camera-Processor is dependent upon
1. the position of the lensboard
2. the placement of the copy in the proper rectangle on the copyboard
3. the position of the copyboard
4. all of the above

9-39. Which positioning of the bulbs should you observe when replacing them in the camera lamps?
1. Both the clear window of the lower bulb and the opaque back of the upper bulb face the copyboard
2. The opaque back of the upper bulb faces the reflector and the clear window of the lower bulb
3. Both the clear window of the lower bulb and the opaque back of the upper bulb face the reflector
4. The opaque back of the upper bulb faces the copyboard and the clear window of the lower bulb faces the reflector

9-40. When you make the exposure, you may need to increase the exposure time to do any of the following except
1. reduce shadow lines
2. drop blue from the background
3. broaden thin lines
4. expose through zipatone

9-41. For which of the following purposes is the adjustable curtain in the 3M Camera Processor used?
1. To act as a filter to correct certain defects in the copy and to decrease the exposure time
2. To provide light protection for the roll and to control the area of exposure on the plate material
3. To provide a means of varying the contrast and to compensate for the light intensity
4. To control the amount of exposure of the plate material to the developer and to compensate for the thickness of oversized originals

9-42. After installing a new roll of plate material in the magazine, you should prepare the camera for operation by
1. exposing the first 10 inches of the new roll
2. setting the plate length indicator to the length normally used and turning on the splice detector switch
3. swinging the magazine into position and locking it
4. doing all of the above

9-43. After the plate is processed through the tanks, it is dried by
1. heated rubber rollers
2. heating lamps
3. blasts of hot air
4. squeegees

9-44. Daily maintenance of the 3M Camera-Processor consists of all of the following operations except
1. draining one quart of developer and replacing with fresh developer
2. changing the activator solution
3. cleaning the entrance and exit rollers with line-free cloth
4. checking the level of the tanks and replenishing with water if necessary

9-45. The rollers of the transport stations may be scoured with
1. steel wool
2. mild detergent
3. scouring powder
4. nylon scouring pads

9-46. How often should you lubricate the magazine motor of the 3M Camera-Processor?
1. Once every week
2. Once each two weeks
3. Once each six weeks
4. Once each six months

9-47. Which plate trouble may be caused by a dirty lens?

1. Scumming
2. Blurred image
3. Blind plate
4. Crooked image

Learning Objective: Recognize the characteristics of and the processing procedure used with Metalphoto plates.

9-48. What is the physical description of the Metalphoto plates?

1. A surface composed of photographic film that is bonded to a stainless steel base
2. A photosensitive surface on a plastic and metal base
3. A light-sensitive surface that is bonded to a base composed of three layers of metal
4. A light-sensitive coating that is impregnated into the surface of an aluminum base

9-49. What types of containers should be used to store the processing chemicals for Metalphoto plates?

1. Glass or metal
2. Glass or plastic
3. Metal or plastic
4. Rubber or metal

9-50. Metalphoto plates may be developed and fixed in trays using the procedure that is similar to that used for

1. sheet film
2. subtractive plates
3. presensitized plates
4. multimetal plates

9-51. At what point in the processing of a Metalphoto plate must stains be removed from the plate?

1. Immediately after the plate has been developed
2. Immediately after the plate has been fixed
3. Immediately after the plate has been sealed
4. Before the plate has been developed

Learning Objective: Recognize characteristics of the kinds of lithographic printing presses.

9-52. For what reason are some offset presses referred to as "web-fed" presses?

1. They produce print from a relief plate
2. They print on paper fed from a roll
3. They were built by J. F. Webendorfer
4. They print two colors on one trip through the press

9-53. "Successive feeding" of sheets differs from "stream feeding" sheets in that in "successive feeding" the sheets

1. are fed from a feed pile
2. travel down a feedboard to the printing unit
3. overlap one another on the feedboard
4. have a slight space separating them on the feedboard

9-54. Which feature of the multicolor press allows the press to print more than one color in a single run?

1. Two or more inking systems and one plate
2. One inking system and two or more plates
3. Two or more printing units
4. One plate and two or more impression cylinders

9-55. An offset press that is equipped to print on both sides of the paper in a single run is known as a

1. web press
2. perfecting press
3. sheet-fed press
4. multicolor press

9-56. Which press uses relief plates and thereby eliminates the need for a dampening system?

1. Perfecting press
2. Multicolor press
3. Web press
4. Dry offset press

Learning Objective: Recognize the components of the printing unit and the basic principle of operation of a single-color offset press.

- Items 9-57 through 9-75 pertain to a sheet-fed, single-color offset press.

9-57. The printing unit of the press includes all of the following major components except the
1. ink fountain and rollers
2. blanket, plate, and impression cylinders
3. skeleton cylinder
4. water fountain and rollers

9-58. During operation of the press, the plate on its cylinder contacts (A) the blanket cylinder, (B) the inking rollers, and (C) the dampening rollers. In which sequence are these contacts made?
1. C, B, A
2. A, B, C
3. B, C, A
4. C, A, B

9-59. When, if ever, does the image to be printed read right-to-left in the printing unit?
1. On the blanket cylinder
2. On the plate
3. On the impression cylinder
4. Never

9-60. Which cylinder prints the image onto the paper?
1. The plate cylinder
2. The impression cylinder
3. The blanket cylinder
4. The skeleton cylinder

Learning Objective: Identify components and recognize their functions in the inking system of the offset press.

9-61. The two main components of an ink fountain on an offset press are the
1. force feeder and the reservoir
2. ductor roller and the fountain roller
3. metal fountain roller and the vibrator roller
4. steel blade and the metal fountain roller

- Items 9-62 through 9-65 pertain to the relationship of the inking rollers and the route of the ink from the fountain to the plate. Consider the following alternatives:
1. ductor roller
2. idler rollers
3. form rollers
4. vibrator rollers

9-62. The ink is passed directly from the fountain roller to the

9-63. The image on the plate is inked by the

9-64. Which rollers move sidewise as they rotate?

9-65. Before the ink reaches the oscillating rollers it is further broken down by the

9-66. The pressman makes the ink run heavier over one area of the plate than over another area of the plate by
1. adjusting the fountain keys
2. regulating the ink feed rachet
3. turning the fountain roller by hand
4. manipulating the ink feed rachet lever

9-67. By which method does the ink feed ratchet regulate the flow of ink?
1. By varying the distance between the blade and the fountain roller
2. By changing the speed of the fountain roller
3. By varying the back and forth movement of the ductor roller
4. By changing the speed of the vibrator roller

Learning Objective: Identify components and recognize their functions in the dampening system of the offset press.

9-68. The dampening system is comparable to the inking system except that in the former the
1. water supply is controlled by a ratchet adjustment
2. form rollers contact the plate
3. ductor and form rollers are usually covered with molleton
4. water is transferred from the fountain roller to the ductor roller

9-69. Which dampening system roller makes direct contact with the plate?
1. Form roller
2. Ductor roller
3. Fountain roller
4. Distributor roller

9-70. The distribution and flow of water in the dampening system may be controlled by any of the following methods except
1. governing the rotation of the fountain roller with a ratchet adjustment
2. controlling the supply of water in local areas by the use of water stops
3. controlling the amount of time the ductor contacts the fountain roller by adjusting a screw or cam
4. governing the solution flow by adjustment keys and metal blade

9-71. The suggested way of preventing moistening troubles caused by switching from one type of plate to another is to
1. keep a separate set of dampeners for each type of plate
2. replace the cloth covering of the dampener rollers with Teflon covering
3. wash the dampeners between runs of different types of plates
4. keep a separate set of inking rollers for each type of plate

9-72. Why are dampener form rollers in some shops covered with paper covers instead of cloth covers?
1. Paper covers are more economical and usually stay clean longer
2. Paper covers more uniformly contact the plate and remain clean longer
3. Paper covers are interchangeable with cloth covers and are more durable
4. Paper covers make better contact with the plate and are easier to install

9-73. Assume that a dampener form roller is two feet long and three inches in diameter. What length should you cut the parchment strip to cover the roller?
1. 11 1/2 feet
2. 12 feet
3. 13 feet
4. 14 1/2 feet

9-74. After you wrap the dampener form roller with a paper strip cover, you should fasten the ends of the strip with
1. drawstrings
2. rubber bands
3. rubber cement
4. cellulose tape

9-75. To increase the effectiveness of the fountain solution, you may modify the solution by adding
1. phosphoric acid
2. ammonium dichromate
3. gum arabic solution
4. anhydrous grain alcohol

Assignment 10

The Offset Press (continued); The Multilith 1250 Press

Textbook NAVEDTRA 10452-C: Pages 288-332

Learning Objective: Determine procedures of mounting the blanket and the plate on their respective cylinders, obtaining the pressure between the blanket and plate, and positioning the image on the paper.

● Items 10-1 through 10-28 continue the discussion of a sheet-fed, single-color offset press.

10-1. What thickness of overpacking does the pressman use to obtain the recommended "squeeze" for presensitized plates on the smaller presses?

1. 0.001 inch
2. 0.002 inch
3. 0.003 inch
4. 0.004 inch

10-2. Assume that the undercut section of the plate cylinder and the undercut section of the blanket cylinder totals 0.007 inch. The average "miked" thickness of the blanket is 0.002 inch, and the average "miked" thickness of the plate is 0.004 inch. To obtain the recommended printing pressure of 0.003 inch on the larger press, how much packing should you add to the plate and/or blanket cylinders?

1. 0.001 inch
2. 0.002 inch
3. 0.003 inch
4. 0.004 inch

10-3. Which of the following dimensions of the blanket should you measure to determine that the blanket is square?

1. Both sides, the leading edge, and the trailing edge
2. The trailing edge and one side of the blanket
3. The two diagonals across the blanket
4. The two sides of the blanket

10-4. Assume that you have attached the clamp bars to the blanket, measured the blanket, and determined the amount of packing that you need. What is your next step when you attach the blanket to the blanket cylinder?

1. Attaching the clamp bar of the leading end to the cylinder reel rod
2. Inserting the clamp bar of the tail end under the locknuts of the gripper edge of the cylinder
3. Inserting the clamp bar of the leading end under the locknuts of the gripper edge of the cylinder
4. Attaching the clamp bar of the tail end to the cylinder reel rod

10-5. Before mounting the plate around the plate cylinder, the pressman determines the amount of underpacking required by measuring the thickness of the plate with a

1. micrometer
2. ruler
3. feeler gauge
4. caliper

10-6. Mounting the plate on the plate cylinder differs from mounting the blanket on the blanket cylinder in that when you mount the plate you

1. rotate the cylinder by hand or by inching the press to draw the plate around the cylinder
2. place the packing under the plate before you rotate the cylinder
3. draw the plate taut around the cylinder by tightening the tail edge of the plate
4. attach the top edge of the plate into the upper clamps of the cylinder gap

10-7. Components on the press that you may adjust to compensate for a slightly faulty positioning of the image on the paper include
1. the plate
2. the plate cylinder
3. the feedboard guide or the side registering device
4. all of the above

10-8. Which of the following cylinders is equipped with automatic grippers and is sometimes called the "back" cylinder?
1. Plate cylinder
2. Blanket cylinder
3. Impression cylinder
4. Skeleton cylinder

Learning Objective: Determine functions and adjustment procedures of components in the feeder unit and the delivery unit of the offset press.

10-9. Which of the following components of an offset press is actuated from the control panel and operates independently of the rest of the press?
1. Delivery grippers
2. Vacuum pump
3. Ink fountain roller
4. Water ductor roller

10-10. As the sheet of paper moves from the feed table to the impression cylinder, it is controlled by (A) forwarding rollers, (B) suction feet, (C) front guides, (D) conveyor tapes, and (E) a side guide. In which sequence does the sheet come in contact with these components of the feeder unit?
1. B, A, D, C, E
2. B, D, C, E, A
3. D, A, E, C, B
4. B, E, A, D, C

10-11. Which components of the feeder unit serve as a guide when the paper stock is loaded and also steady the paper when it feeds into the press?
1. Forwarding rollers
2. Front guides
3. Piling bars
4. Sucker feet

10-12. Why should you fan each lift of stock as you load the feed table?
1. To aerate the sheets
2. To straighten the sheets
3. To check for defective sheets
4. To estimate the number of sheets

For items 10-13 through 10-16 use the following alternatives:
1. Forwarding rollers
2. Pile height governor
3. Sucker feet
4. Caliper

10-13. If the separator fingers are improperly adjusted, they may interfere with the operation of the

10-14. Damage to the blanket or jamming of the press by double sheets is prevented by the action of the

10-15. The speed of elevation of the feed table is controlled by the

10-16. The sheets will tend to feed crooked as a result of unequal pressure of the

10-17. For what reason do some pressmen attach brushes to the holddown rods?
1. To prevent the buildup of static electricity
2. To prevent the paper from bouncing as it hits the front guides
3. To prevent the sucker feet from picking up more than one sheet from the feed pile
4. To reduce the wear of the tapes as they contact the holddown rods

10-18. What relationship between image and sheet results when the pressman moves the front guides farther away from the impression cylinder?
1. The image prints lower on the paper
2. The image prints to the right on the paper
3. The image prints higher on the paper
4. The image prints to the left on the paper

10-19. To ensure proper registration, about how far is each sheet moved sidewise by the side guide?
1. 1/4 of an inch
2. 1/8 of an inch
3. 2/1000 of an inch
4. 4/1000 of an inch

10-20. Which action is initiated by the sheet detector finger to prevent the blanket from printing on the impression cylinder when a sheet fails to feed through?
1. Stopping the press
2. Stopping the sheet feeder
3. Tripping off the dampening system
4. Tripping off the ink and the impression

10-21. The number of sets of delivery grippers on a press is determined by the
1. speed of the press and the distance between the impression cylinder and the feeder platform
2. distance between the impression cylinder and the delivery platform and the speed of the press
3. speed of the press and the size of the press
4. distance between the blanket cylinder and the delivery platform and the speed of the press

---

Learning Objective: Recognize the steps of preparing and operating the offset press.

10-22. By which method should you ink the press when preparing to run a job on it?
1. Run the press and distribute ink from the can evenly along the inking rollers
2. Pour the ink from the can into the ink fountain
3. Take the ink from the can and work it out with a palette knife along the length of the ink ductor roller
4. Remove the ink from the can, work it out with a palette knife on stone or glass, and distribute it in the ink fountain

10-23. During the makeready procedures, what should you do next after you distribute ink and water over the rollers?
1. Mount the plate
2. Set the feeder
3. Print the trial sheet
4. Mount and clean the blanket

10-24. Approximately how many waste sheets are inserted among the top sheets of the paper stack for use in the makeready operation?
1. 4 or 5
2. 10 to 25
3. 30 to 40
4. 60 to 100

10-25. At what instant does the pressman throw on the impression to print a trial sheet?
1. When the impression cylinder grippers grasp the sheet
2. As the sheet touches the front guides
3. As the sheet contacts the forwarding roller
4. When the feeder sucker lifts the sheet from the stack

10-26. Which of the following components may be adjusted to straighten an image that prints slightly crooked on the trial sheet?
1. Caliper
2. Side guides
3. Front guides
4. Delivery joggers

10-27. The pressman checks the register of the printing job by
1. watching the printed line along the edge of the delivery stack while the press is running
2. removing a sheet during the run and measuring the distance between the register mark and the top of the sheet
3. stopping the press and comparing a printed sheet against the image on the plate
4. stopping the press and fanning several of the top sheets to see if the register marks are aligned

10-28. In what order should you use cleaning and storing materials on a plate after the job is completed?
1. Asphaltum, gum arabic, and solvent
2. Gum arabic, solvent, and asphaltum
3. Solvent, asphaltum, and gum arabic
4. Gum arabic, asphaltum, and solvent

Learning Objective: Distinguish between safe and unsafe practices around the offset press.

● Items 10-29 through 10-40 are to be judged either True (a safe practice) or False (an unsafe practice) based on the following: LI2 Dean is an experienced operator of an ATF Chief 20A press and is responsible for the press and the shop area surrounding it.

10-29. At the beginning of the day, Dean inspects the oil drip pans and packs them with cotton.

10-30. Dean picks up the paper litter from the floor and tosses it into the metal rag container.

10-31. While oiling the press, Dean spills oil on the floor. He wipes it up with a rag and puts the oily rag into the waste paper container.

10-32. Dean has supplemented the operating instructions on the nearest fire extinguisher with instructions on how to report a fire.

10-33. Dean rolls up his shirt sleeves, puts on his apron, and ties the apron strings very tight around his waist.

10-34. After he mounts the plate, Dean puts the ratchet wrench in his hip pocket for convenience.

10-35. Dean assures himself that all of the safety guards are in place before he starts the press.

10-36. He turns on the press after making certain that everyone is in the clear.

10-37. The sheets begin to jam in the press. Dean reaches across the operating press and quickly adjusts the caliper to correct the malfunction.

10-38. When the job run is completed at the end of the day, Dean stops the press, removes the ink, and cleans the ink fountain with a small amount of solvent.

10-39. He lights a cigarette, raises the window, and begins cleaning the blanket with solvent.

10-40. Dean makes a very detailed inspection of the press and area and carefully cleans the blanket and impression cylinder after he has completed a run of classified material.

Learning Objective: Recognize causes and remedies of offset press difficulties.

In items 10-41 through 10-44, select from column B a cause of the press difficulty in column A.

	A. Press Difficulty	B. Cause
10-41.	Impression gray	1. Image twisted on plate
10-42.	Misregister	2. Water and ink distribution unbalanced
10-43.	Ink impression too heavy	3. Too much water
10-44.	Plate does not print unevenly on blanket	4. Insufficient water

---

In items 10-45 through 10-48, select from column B the remedy which corrects one cause of the press difficulty in column A.

	A. Press Difficulty	B. Remedy
10-45.	Ink offsets from one sheet onto the back of another	1. Increase amount of water
10-46.	Ink impression too heavy	2. Adjust pressure between blanket and impression cylinder
10-47.	Image does not print on paper	
10-48.	Plate not inked uniformly	3. Add drier to the ink
		4. Adjust dampener form roller

Learning Objective: Describe the various components, operating procedures, and adjustment requirements of the Multilith 1250 press.

10-49. What is the speed range of the Multilith press?
1. 500 to 1500 impressions per hr
2. 1000 to 2000 impressions per hr
3. 2000 to 4000 impressions per hr
4. 4500 to 9000 impressions per hr

10-50. Which of the following controls on the Multilith press operates the printing unit?
1. The single lever control
2. The machine switch
3. The speed control knob
4. The repelex controls

10-51. How many dampening rollers are in the dampening system of the Multilith press?
1. One
2. Two
3. Three
4. Four

10-52. Which of the following rollers in a Multilith dampening system contacts the plate?
1. Rider roller
2. Form roller
3. Ductor roller
4. Knurled metal fountain roller

10-53. One way to decrease the amount of water fed to the dampening system is to move the
1. feed control lever toward the feeder end of the press
2. fountain roller speed lever to the right
3. feed control lever toward the delivery end of the press
4. fountain roller speed lever to the left

10-54. One method you may use to increase the supply of water to the dampening system for short periods is to
1. increase the accelerations of the ductor roller
2. increase the water level in the fountain
3. rotate the fountain roller by turning a knob
4. push the fountain roller speed control lever toward the feeder

10-55. At the beginning of a run, in which order does the operator set the fountain keys to regulate the thickness of the film of ink?
1. From the left side of the fountain to the right side
2. From the middle of the fountain toward each side of the fountain
3. From each end of the fountain toward the middle
4. From the right side of the fountain to the left side

10-56. The blanket on a Multilith press is tightened by means of
1. a reel ratchet and pawl
2. thumbscrews
3. clamp bars and quoin locks
4. clamp screws and locknuts

10-57. Which type of plates does the Multilith use?
1. Plastic
2. Metal plates
3. Paper plates
4. Any of the above

10-58. To square the image with the paper, you straighten the plate on a Multilith press with lateral adjustment by turning the
1. thumbscrews in the same direction
2. adjusting screws in opposite directions
3. thumbscrews in opposite directions
4. adjusting screws in the same direction

10-59. After the undercut section of the plate cylinder has been loosened, you may lower the image by turning the
1. handwheel counterclockwise
2. notched adjusting screw clockwise
3. handwheel clockwise
4. notched adjusting screw counterclockwise

10-60. Which of the following Multilith feeder components should be adjusted first?
1. Left side guide
2. Piling bars
3. Stationary guide
4. Feed table height

10-61. After running several test sheets through the press, you decide that the right margin should be slightly increased. How do you accomplish this adjustment after stopping the press?
1. Move the stationary guide to the right
2. Turn the micrometer disk clockwise
3. Rotate the micrometer disk counterclockwise
4. Move the left front guide to the left

10-62. Between which two components is the paper held in place on the feedboard of the Multilith?
1. Stationary side guide and the front guides
2. Left side guide and the front guides
3. Paper retainer and the left side guide
4. Left side guide and the stationary side guide

10-63. Which feed table component is adjusted to agree with the scale setting of the left side guide?

1. Right piling bar
2. Left paper support
3. Left piling bar
4. Pile-height control bar

10-64. Which feed table component may be reversed to provide better sheet control of short stock?

1. Left stack guide
2. Back paper stop
3. Right stack guide
4. All of the above

10-65. Where should the blower holes be positioned in relation to the top of the paper stack?

1. Bottom hole just above the top of the stack
2. Top hole just below the top of the stack
3. Top hole just above the top of the stack
4. Middle hole just above the top of the stack

10-66. Which combination of adjustments should you make for running lightweight stock on the Multilith?

1. Move blower tubes to the back position, set the separator fingers for maximum extension, and turn the suction adjusting knob clockwise
2. Leave the blower tubes in the front position, set the separator fingers for maximum extension, and turn the suction adjusting knob clockwise
3. Move blower tubes to the back position, set the separator fingers for maximum extension, and turn the suction adjusting knob counterclockwise
4. Move blower tubes to the back position, remove the separator fingers, and turn the suction adjusting knob clockwise

10-67. What preparation do you make when you set the multiple sheet detector on the Multilith?

1. Lowering the feed table
2. Turning on the press
3. Turning on the vacuum
4. All of the above

10-68. As the paper passes through the press, it moves from the

1. lower rollers to the pullout rollers to the conveyor tapes
2. pullout rollers to the lower rollers to the conveyor tapes
3. conveyor tapes to the pullout rollers to the lower rollers
4. pullout rollers to the conveyor tapes to the lower rollers

10-69. What removable equipment for sheet control of short, heavy stock is found in most Multilith presses?

1. Form rollers
2. Skid rollers
3. Feed rollers
4. Pullout rollers

10-70. What component of the press controls the timing of the feed rollers and the front guides?

1. The blanket cylinder
2. The impression cylinder grippers
3. The cam bands
4. The stop plates

10-71. What adjustment is probably needed when the sheets of paper flutter through the delivery end of the press?

1. The cam band should be advanced
2. The front guides should be tightened
3. The feed roller should be engaged
4. The cam band should be retarded

10-72. The detent pawl is used to

1. actuate the automatic counter
2. throw on the impression
3. bring the plate into contact with the blanket
4. do both 1 and 2 above

10-73. Through which rollers on the press do the sheets pass when they leave the impression cylinder?

1. The tape rollers
2. The skid rollers
3. The ejector rollers
4. The pullout rollers

10-74. What device is used to remove static electricity from paper leaving the delivery system?

1. Ejector rings
2. Tinsel strips
3. Steel strips
4. Copper wire brushes

Assignment 11

The Multilith 1250 Press (continued); The A. B. Dick Offset Duplicator, Model 350; The ATF Chief 20 and 20A Presses

Textbook NAVEDTRA 10452-C: Pages 332-392

Learning Objectives: Recognize adjustments necessary to improve the quality of work or to correct a malfunction.

11-1. Which of the following factors determine the frequency that adjustments should be made on your Multilith press?
1. Monthly, on a regular basis
2. Only when you are certain adjustments are needed
3. After the press has operated a particular number of hours
4. On a regular basis, as described in the operating manual for your press

11-2. What testing devices are used to check the pressure on both the feed roller and the dampener form roller?
1. Strips of paper
2. A full sheet of 20 pound paper
3. A piece of tinsel
4. A spare cylinder blanket

- Use the following alternatives for items 11-3 through 11-6 which describe adjustments that a thoroughly qualified Multilith operator may make.

1. Turn the eccentric shaft adjustment counterclockwise
2. Push the eccentric bearing in as far as it will go
3. Turn the eccentric shaft clockwise
4. Adjust the operating control lever

11-3. Which adjustment reduces the end play of the ink roller?

11-4. What adjustment does the operator make to increase the pressure between the plate and the blanket cylinder?

11-5. How would you increase the pull on the far end of an ink roller?

11-6. Which adjustment decreases the overall tension of the dampener form roller?

11-7. Sheets are coming off the press with light printing on the far side of the sheet. In which direction does the press operator move the leveling sector pointer to correct this condition?
1. Toward the "lower" mark
2. Toward the "decrease" mark
3. Toward the "increase" mark
4. Toward the "raise" mark

Learning Objective: Determine the periodic inspection necessary to carry out an effective maintenance program.

11-8. How frequently should the form roller bearings be greased?
1. Daily
2. Weekly
3. Monthly
4. Quarterly

11-9. When cleaner sheets are used to clean a Multilith press, the ink form rollers are dropped on the cylinder and the press is run while the pressman
1. squeegees off the thinned ink into a metal pan
2. cuts the ink off with a rubber blade
3. pours solvent over the rollers
4. pours water over the rollers

11-10. In what order, from first to last, are the ink rollers replaced after they have been cleaned?
1. Upper distributing roller, idler rollers, form rollers, and ductor roller
2. Form rollers, upper distributing roller, ductor roller, and idler rollers
3. Ductor roller, form rollers, upper distributing roller, and idler rollers
4. Form rollers, ductor roller, idler rollers, and upper distributing roller

11-11. Which of the following parts should be periodically soaked in blanket wash?
1. Molleton-covered dampeners
2. Conveyor tapes
3. The ink fountain
4. Vacuum pump filters

11-12. Which of the following solutions is used to preserve metal plates?
1. Gum arabic
2. Lithotine
3. Detergent
4. Counteretch

11-13. Which of the following feeder components may be removed when extra heavy stock is run through the press?
1. Caliper
2. Upper feed roller
3. Right side guide
4. Separator finger

Learning Objective: Determine the operational controls and characteristics of the A. B. Dick Offset Duplicator, Model 350.

Items 11-14 through 11-38 pertain to the A. B. Dick Offset Duplicator, Model 350.

11-14. The printing unit of the A. B. Dick press differs from the printing unit of the Multilith 1250 in that the former printing unit has
1. one common fountain for both the ink and the fountain solution
2. only one plate cylinder, one impression cylinder, and one blanket
3. one set of form rollers for the ink and the fountain solutions
4. a separate set of rollers for the ink and the fountain solutions

11-15. You push the activator lever of the late model A. B. Dick press to the "feed" position. What happens to the lever when you release it?
1. It automatically returns to the "neutral" position
2. It automatically returns to the "ink" position
3. It remains in the "feed" position
4. It automatically returns to the "image" position

11-16. What combination of control settings on the A. B. Dick Offset Duplicator, Model 350, are made to get the proper printing operation with the press?
1. The paper feed control lever in the lowered position and the operation control lever in the "ink" position
2. The paper feed control lever in the raised position and the operation control lever in the "image" position
3. The paper feed control lever in the lowered position and the operation control lever in the "image" position
4. The paper feed control lever in the raised position and the operation control lever in the "ink" position

11-17. What is the purpose of lever "C" on the press shown in figure 13-5 of the textbook?
1. To momentarily increase the ink supply on the fountain roller
2. To control the paper feed through the press
3. To move the ink form rollers into contact with the plate cylinder
4. To permit a build up of the image on the blanket before sheets are fed through the press

11-18. Which aquamatic unit roller, if any, requires a molleton or paper cover?
1. None
2. Fountain roller
3. Ductor roller
4. Oscillating roller

11-19. Maximum water supply for the aquamatic unit is provided by setting the regulating lever at No.
1. 15
2. 25
3. 35
4. 45

11-20. What is the purpose of the aquamatic lock-out latch on the late model of the press?
1. To prevent the form rollers from contacting the plate
2. To regulate the amount of water being supplied to the form rollers
3. To prevent extra water from backing into the inking system when the press is turned backwards
4. To free the aquamatic ductor roller when the press is turned off

11-21. In addition to bending or creasing the plate, what adjustment do you make when mounting a metal plate on the plate cylinder?
1. Reduce the spring tension
2. Tighten the head clamp slightly
3. Loosen the head clamp slightly
4. Tighten the tail clamp slightly

11-22. Which of the following components may you adjust to correct the position of the image on the paper?
1. The plate cylinder head clamp
2. The feeder set-up
3. The impression cylinder
4. Any of the above

11-23. The sucker feet of the automatic feeder transfer the sheets of paper from the pile to the
1. forwarding rollers
2. cylinder grippers
3. feedboard
4. front guides

11-24. Setting the automatic feeder, after the paper stock has been loaded, includes the following steps: (A) set the backstop behind the pile, (B) set the paper guides, (C) raise the top of the pile to the paper height regulator, and (D) square the top sheets of the pile against the front plate. In which order should you perform these steps?
1. B, A, C, D
2. A, C, D, B
3. C, D, B, A
4. C, B, A, D

11-25. The paper levelers are designed to
1. assist in feeding lightweight stock
2. help prevent double sheeting
3. aid in feeding curled stock
4. do all of the above

11-26. The amount of pulling power that the sucker feed exert on the various paper stacks during the operation of the press may be controlled by the
1. speed of the suction motor
2. level of the paper stock in relation to the feet
3. types of tips that are installed on the feet
4. position of the feeder crank that positions the piling bar

11-27. The forwarding rollers deliver the sheet to the impression cylinder grippers by
1. giving it forward momentum
2. raising it up to meet the grippers
3. depositing it on the conveyor tapes
4. forcing it against the gripper stops

11-28. When replacing the rubber forwarding rollers, you may find it advisable also to
1. replace the shaft bearings
2. have the lower roller reground
3. reset the sheet detector fingers
4. readjust the forwarding roller cam

11-29. Your press is feeding more than one sheet at a time. You may eliminate this problem by
1. lowering the height of the paper pile
2. using the control knobs to reduce the blast and suction
3. doing both 1 and 2 above
4. lowering the sucker feet

11-30. To correct for too much buckle in sheets received by the cylinder grippers you
1. adjust the paper stops
2. move the sucker feet away from the cylinder
3. reduce the speed of the press
4. move the sucker feet toward the cylinder

11-31. The purpose of the sidewise adjustment of the ejector rollers is to
1. guide the printed sheet into the receiving tray
2. prevent the wet ink from smearing
3. register the sheets in the paper receiver
4. compensate for stock curling up or down

11-32. The impression per hour speed range of this press is between
1. 2500 and 4500
2. 3500 and 6000
3. 4500 and 9000
4. 6500 and 9500

Learning Objective: Recognize the press adjustments, cleaning procedures, and maintenance of the A. B. Dick press, Model 350.

11-33. For which of the following adjustments should you put the night latch on to free the rollers?
1. End play of the form rollers
2. Roller-to-plate tension
3. Form roller and tension
4. Aquamatic ductor roller to oscillator roller

11-34. Which of the following settings is automatic and factory adjusted so that the pressman can omit it from his regular preparations for a run?
1. Aquamatic ductor to oscillator roller
2. Form roller to plate tension
3. Cylinder gripper tension
4. Plate to blanket tension

11-35. Which of the following components of the A. B. Dick, Model 350 press do you clean during the wash-up operations at the end of each day?
1. The water and ink systems
2. The plate and blanket cylinder system
3. The water system and the plate cylinder
4. The ink system and the blanket cylinder

11-36. Why should you separate the rollers during long shut-down periods and at the and of the day?
1. To prevent the rollers from becoming flat
2. To allow the cleaning solvent to dry
3. To relieve the tension on the rollers
4. To do both 1 and 3 above

11-37. When you prepare the press to make a run, at what step in the operation do you apply the fountain solution?
1. After you load the stack on the feed table
2. After you mount the plate on the cylinder
3. Before the rollers are inked
4. After the rollers are inked

11-38. Which of the following cleaning procedures is an important part of press maintenance?
1. Cleaning of the rollers
2. Cleaning of the cylinder
3. Cleaning of the feeder and delivery components
4. Doing each of the above

Learning Objective: Recognize the various components, operating adjustments, and maintenance procedures that apply to the ATF Chief 20 press.

- Items 11-39 through 11-67 pertain to the ATF Chief 20 press.

11-39. What is the minimum size of stock that can be printed on the "Little Chief" press?
1. 3" x 3"
2. 3" x 5"
3. 8" x 10"
4. 9 1/2" x 13"

11-40. Which of the following controls is located on the control panel at the feeder end of the press?
1. The "inching latch"
2. The vacuum pump switch
3. The adjustomatic drive knob
4. The feeder control lever

11-41. Which action starts feeding the sheets through the press?
1. Turning on the vacuum pump
2. Pushing the start button
3. Releasing the safety latch
4. Pushing down the feeder control lever

11-42. The impression may be thrown off by any of the following methods except by
1. pushing in the emergency throw off lever
2. automatic operation of the sheet detector finger
3. raising the feed control lever
4. raising the impression throw off lever

11-43. What will prevent the feed table from working against the tail guides at the end of a run?
1. Setting the tail guides farther forward on the rod
2. Setting blocks under the last lift of stock
3. Adjusting the setting of the pile height governor
4. Positioning the tail guides over the slots in the feedboard

11-44. What is the recommended distance between the back edge of the stock and the pile height governor?
1. 1/2 in.
2. 1 in.
3. 1 1/2 in.
4. 2 in.

11-45. After moving the sucker feet, what should you do before starting the press?
1. Tighten the sucker floor bolt
2. Make sure the air hoses are reconnected
3. Realign the grooves in the sucker feet
4. Make sure the feet clear the forwarding rollers

11-46. You may correct the failure of sucker feet to pick up thin card stock by any of the following means except
1. exchanging the one-suction hole feet for three-suction hole feet
2. moving the sucker feet sidewise
3. regulating the amount of suction
4. slipping rubber tips over the sucker feet

11-47. The caliper shown in figure 14-10 of the textbook is adjusted so as to allow
1. single sheets of paper to feed to the press
2. correct alignment of the sheets of paper
3. the sucker feed to move freely
4. different size sheets to feed through the press

11-48. Which combination of sheet controls should you use for a run of heavy stock that is 8 inches long?
1. Glass rider balls and two driver wheels
2. Steel rider balls and four driver wheels
3. Glass rider balls and four driver wheels
4. Steel rider balls and two driver wheels

11-49. Which of the following paper control mechanisms is attached to the front guide shaft?
1. Gripper edge sheet guards
2. Speed wheels
3. Forwarding rollers
4. Guide ball carriers

11-50. What should be the position of the sheet detector finger in relation to the sheet detector finger slot when the impression is on?
1. Directly above the slot
2. Directly behind the slot
3. Directly in front of the slot
4. On either end of the slot

11-51. What is the range of gripper bit adjustments of the frong guides?
1. 1/8 in.
2. 1/4 in.
3. 3/8 in.
4. 1/2 in.

11-52. What procedure may be used to make fine adjustments to the side guide on the press?
1. Moving the side guide itself
2. Adjusting the micrometer screw
3. Moving the stock
4. Changing the feeder setup

11-53. Before the blanket is mounted, it should be dusted with
1. pumice and rouge
2. rouge and flowers of sulfur
3. flowers of sulfur and talcum powder
4. talcum powder and pumice

11-54. When mounting a blanket, you should tighten the trailing edge lugs of the blanket cylinder from
1. right to left
2. side lugs to center lug
3. left to right
4. center lug to the side lugs

11-55. What is the total thickness of (A) the plate and packing and (B) the blanket and packing?
1. (A) 0.002 inch, (B) 0.063 inch
2. (A) 0.011 inch, (B) 0.073 inch
3. (A) 0.010 inch, (B) 0.071 inch
4. (A) 0.063 inch, (B) 0.010 inch

11-56. For which of the following reasons should you turn the press for one revolution either by hand or by inching it?
1. To wrap the blanket around the cylinder after you have added the packing sheets
2. To throw off the impression after you have mounted the plate
3. To prevent damage to the cylinders before you turn the press on at full speed
4. For any of the above reasons

11-57. What should you do when a plate prints the image more than 1/8 inch crooked?
1. Have the plate remade
2. Walk the plate on the cylinder
3. Move one front guide ahead of the other
4. Walk the plate on the cylinder and move the front guides

11-58. Which action shuts off the dampening system water supply completely?
1. Moving the cam control lever toward the feeder end of the press
2. Engaging the pawl with the ratchet
3. Moving the cam control lever toward the delivery end of the press
4. Disengaging the pawl from the ratchet

11-59. What is the position of one set of delivery grippers in relation to the other set when the delivery table side joggers are at the innermost part of their thrust?
1. One set is preparing to release a sheet to the delivery board and the other set is ready to receive a sheet from the impression grippers
2. The two sets are horizontally aligned
3. The two sets are vertically aligned
4. Both sets of delivery grippers are being opened by their individual cams

11-60. In addition to lubricating and replacing defective parts on the press, press maintenance requirements also include
1. carrying out washup procedures
2. replacing dampener roller covers
3. replacing worn tapes
4. doing all of the above

11-61. How frequently should the ink ductor bearings be lubricated?
1. Every four hours
2. Twice daily
3. Daily
4. Weekly

11-62. The inner covering on dampener rollers requiring two coverings is usually made of
1. molleton
2. flannel
3. muslin
4. paper

11-63. Which method is used to determine whether the plate cylinder is parallel with the blanket cylinder?
1. Checking the ink spots that transfer from the plate cylinder bearers onto the blanket cylinder bearers
2. Checking the image that results from dropping the inked plate onto the blanket
3. Testing the drag on paper feelers inserted between the bearers on both ends of the cylinders
4. Inching a test sheet through the press

11-64. In which order should you adjust the impression cylinder grippers?
1. From the near side to the far side
2. From each end toward the center
3. From the far side to the near side
4. From the center to the sides

11-65. What is the proper clearance between (A) the delivery grippers and the leading edge of the impression cylinder and (B) the blanket cylinder and the impression cylinder grippers?
1. (A) and (B) 1/32 of an inch
2. (A) 1/32 of an inch, (B) 1/16 of an inch
3. (A) and (B) 1/16 of an inch
4. (A) 1/16 of an inch, (B) 1/32 of an inch

11-66. What method is used to get proper tension on the ink and dampener rollers on the ATF Chief 20 press?
1. Using a tension gauge on each roller
2. Turning each adjustment screw all the way down and then backing them off one full turn
3. Using strips of paper between the rollers
4. Rotating each roller and judging the ease of movement

11-67. What should be the position of (A) the dampener form roller and (B) the ink form roller as you set each to its respective vibrator?
1. (A) should contact the plate; (B) should be raised from the plate
2. Both (A) and (B) should contact the plate
3. (A) should be raised from the plate; (B) should be positioned over the cylinder gap
4. (A) should be positioned over the cylinder gap; (B) should contact the plate

---

Learning Objective: Determine the operation and adjustments needed on various components of the ATF Chief 20A press.

- Items 11-68 through 11-73 pertain to the ATF Chief 20A press.

11-68. One way in which the ATF Chief 20A differs from the ATF Chief 20 is that the ATF Chief 20A
1. permits a change in speed during press operation
2. locates all of the operator's controls on the near side of the press
3. possesses a delivery board that automatically lowers
4. has a more complicated method of mounting the blanket

11-69. When you prepare the press to run stock that is 0.002 of an inch thick, you should set the pointer on the thickness gauge to indicate
1. 0.002 in.
2. 0.003 in.
3. 0.005 in.
4. 0.007 in.

11-70. All of the following rollers of the ink unit have tension adjustments except the
1. vibrating rollers
2. ductor roller
3. distributor rollers
4. form rollers

11-71. What identification on the inking or dampening roller journals aids the operator when he places the rollers in their sockets?
1. A letter on each end of the roller
2. Red paint on the near side and green paint on the far side
3. A plus mark stamped on the near side and a minus mark stamped on the far side
4. An even number stamped on the near side and an odd number stamped on the far side

11-72. At which position in the adjustment range of the auxiliary vibrator roller is there least motion of this roller?
1. At the low end of the range
2. At the center of the range
3. Between the center and the low end of the range
4. At the high end of the range

11-73. What is the function of handle (F) on the Chief 20A press shown in figure 14-38 of the textbook?
1. To adjust the stroke of the vibrator rollers
2. To control the speed of the press
3. To move the form rollers toward and away from the plate
4. To raise or lower the feed table

Assignment 12

Paper and Ink

Textbook NAVEDTRA 10452-C: Pages 393-421

Learning Objective: Recognize paper making methods and the types, characteristics, and care of paper.

● Use the following alternatives for items 12-1 through 12-3:
1. Old rags
2. Fine grade, unprinted scrap paper
3. Wood fibers
4. Old, printed waste

12-1. Newsprint is usually made from

12-2. Paper suitable for legal documents can be made from

12-3. Coarse, thick paperboard can be made cheaply from

12-4. Most fine printing paper stocks are made by a sulphite process that involves cooking
1. hard woods in lime and sulphurous acid
2. soft woods in lime and sulphurous acid
3. soft woods in sulphuric acid and caustic soda
4. hard woods in sulphuric acid and caustic soda

12-5. What is the function of the beaters in compounding pulps and other ingredients?
1. Softening of the fibers
2. Fraying the ends of the fibers
3. Removing unwanted gums and resins from the pulp
4. Doing both 1 and 2 above

In items 12-6 through 12-9, select from column B the type of substance that is used for the purpose in column A.

	A. Purposes	B. Substances
12-6.	To increase the paper's opaque quality and even surface	1. Sizing
12-7.	To increase the paper's wet strength	2. Loaders and fillers
12-8.	To prevent excessive moisture penetration	3. Pigments and dyes
12-9.	To produce a variety of colored stock	4. Resins

12-10. What may be added to paper pulp to produce a bright paper surface?
1. Talc
2. Starches
3. Bleaches
4. Resins

12-11. For which of the following reasons are papers coated?
1. To increase ink penetration
2. To give a coarse texture to the paper
3. To give a smoother surface for the printing of halftones
4. To increase wet strength

12-12. Which of the following characteristics of paper is affected by the grain?
1. Changes due to humidity
2. Stiffness
3. Tearing ease
4. All of the above

12-13. On which side of the paper should a letterhead be printed?
1. On the felt side
2. On the wire side
3. Parallel to the grain on either side
4. On the side with the watermark reading from right to left

12-14. The "basic size" of paper can be described as the
1. amount of use area per sheet
2. area of a ream of a specific type of paper
3. standard size for a stock sheet of a specific type of paper
4. size of sheet needed for a specific job order

12-15. What is the basic size used to determine the substance weight of book paper?
1. 24" x 36"
2. 25" x 38"
3. 26" x 40"
4. 28" x 42"

12-16. Seventy-pound book paper has the equivalent weight of what basic weight business paper?
1. 20-pound
2. 28-pound
3. 32-pound
4. 40-pound

12-17. Which of the following one-inch high stacks of paper is made of the bulkiest stock?
1. A stack of 280 sheets
2. A stack of 320 sheets
3. A stack of 520 sheets
4. A stack of 700 sheets

12-18. Which of the following types of paper, as listed in figure 15-8 of your textbook, has the greatest caliper?
1. Mimeo
2. Newsprint
3. Book offset, 50 pounds
4. Ledger, 32 pound

● Alternatives for items 12-19 through 12-25:
1. Book paper
2. Business paper
3. Bristol or card
4. Cover paper

12-19. A light weight paper known as manifold is classified as a

12-20. Supercalendared (SC) paper is a smooth surface type of

12-21. "Safety" paper used for printing checks is one kind of

12-22. Machine finish (MF) chemical wood pulp paper is an inexpensive type of

12-23. A strong, matte finish, colored stock to be used on the outside of a program would be listed as

12-24. For making posters for window displays, you will need

12-25. Carbonless papers with a special coating are a type of

12-26. Although all papers that are used in printing work should be allowed to adjust to the temperature and humidity conditions of the press room, for which paper is this adjustment period most important?
1. Bristol board
2. Newsprint
3. Carbonless paper
4. Lightweight paper

In items 12-27 through 12-30, select from column B the type of paper stock described in column A.

A. Descriptions

12-27. A heavy stock suitable for packing purposes or heavy duty signs

12-28. A light-thin paper used for wrapping or as a base for carbon paper

12-29. A bulky, absorbent stock sometimes coated on one side

12-30. A strong paper used for envelopes and for covering materials to be stored or mailed

B. Types of Paper

1. Wrapping
2. Tissue
3. Blotting
4. Mill blanks or coated blanks

12-31. Which of the following is a disadvantage of recycled paper over "new" paper?
1. Greater production costs
2. Reduced acceptability of ink
3. Softer surface for printing purposes
4. Greater moisture absorption characteristics

12-32. What affect does dry air or moist air have on the size of paper?
1. Dry air causes it to shrink, damp to expand
2. Dry air causes it to expand, damp to shrink
3. Both cause it to expand
4. Both cause it to shrink

12-33. What is the best prevention for the problems of dimensional changes in paper due to atmospheric variations?
1. Leaving the paper in its sealed wrap to season
2. Cutting the paper so that the grain is long
3. Cutting the paper across the grain
4. Storing the paper in the driest part of the ship

Learning Objective: Determine the types of ink that are used, the care of ink, and the problems that are associated with ink on the press.

In items 12-34 through 12-37, select from column B the component of ink that serves the purpose in column A.

A. Purposes

12-34. To provide color for the ink

12-35. To carry the color of the ink

12-36. To furnish relative opacity and lightfastness to the ink

12-37. To make a suitable vehicle for heat-set inks

B. Components

1. Pigment
2. Vehicle
3. Driers
4. Resins

12-38. Which of the following additives is used to provide a special surface to the inked area of the press work?
1. Driers
2. Waxes
3. Anti-skinning agents
4. Retarders

12-39. Which varnish has the highest viscosity?
1. No. 000
2. No. 0
3. No. 3
4. No. 7

12-40. What should you do when you open a can of lithographic ink and it seems stiff?
1. Add varnish and shake
2. Pour or spoon it into the ink fountain
3. Work it out and, if necessary, add varnish a little at a time
4. Add a retarder and stir

12-41. Which of the following terms refer to a process involved in the drying of ink?
1. Penetration
2. Polymerization
3. Oxidation
4. All of the above

12-42. What should you do about ink that has skinned?
1. Work it out to make it fluid
2. Discard the skinned surface
3. Mix it with water
4. Add a thinner to it

12-43. You open a can of ink and remove enough to complete your current job. What substance should you use on the surface of the remaining ink in the can to prevent skinning of the surface?
1. Mineral oil
2. Glycerine
3. Water
4. Kerosene

12-44. Printing with blue ink produces a surface that
1. absorbs the blue component of a white light beam and reflects the other components
2. absorbs the cyan or "process blue" component of the light beam
3. reflects the blue component of the white light and absorbs the other components
4. reflects the primary colors of the white light and absorbs the secondary colors

12-45. When you say an ink is green, you are referring to its
1. value
2. hue
3. chroma
4. intensity

● Items 12-46 through 12-49 refer to the principles involved in the use of colored inks. Mark each item True or False.

12-46. The masstone affects the color that appears on a finished piece of offset printing.

12-47. For map and chart work, you will normally use opaque inks only.

12-48. For making white lettering on a poster of vivid blue, you could get the most permanent opacity by using a titanium white ink.

12-49. For drawing attention to a poster, blue ink is a better choice than deep yellow.

12-50. When you are mixing a color ink, what color ingredient do you add to obtain (A) a tint and (B) a shade of the color?

1. (A) Black, (B) white
2. (A) White, (B) black
3. (A) A complement of the color, (B) black
4. (A) White, (B) a complement of the color

In items 12-51 through 12-53, select from column B the ink that is formulated for the use in column A.

A. Uses

12-51. To print letterheads for your command

12-52. To print a station newspaper

12-53. For the general run of letterpress work

B. Inks

1. Job ink
2. News ink
3. Bond ink
4. Cover ink

12-54. Which of the following letterpress inks is similar in fluidity to news ink?

1. Halftone ink
2. Cover ink
3. Bond ink
4. Job ink

12-55. Recommended practices in caring for rollers include all of the following except

1. thorough cleaning
2. shelf storage
3. storage in a cool, dry area
4. occasional rotation of rollers used

12-56. To remove glaze from improperly cleaned rollers, you should use all of the following procedures except

1. washing the rollers with a solvent
2. using fine pumice as a scrubbing agent
3. rinsing in a lye water bath
4. stripping in a gum arabic solution

12-57. You can reduce stripping of steel ink rollers by

1. increasing the water feed
2. increasing the gum arabic content of the water
3. bathing the rollers in lye water
4. plating the rollers with copper

● Items 12-58 through 12-61 pertain to the use of Teflon roller covers. Mark each item True or False.

12-58. You can make the Teflon cover fit snugly by heating it to shrink it.

12-59. The use of Teflon covers eliminates glazing, stripping, and pitting of rollers.

12-60. Teflon covers are good to use on worn rollers with uneven surfaces.

12-61. It is important to have an exact adjustment of Teflon covers on form rollers.

In items 12-62 through 12-65, select from column B the term used for the ink problem in column A.

	A. Ink Problem	B. Terms
12-62.	An ink condition caused by a reaction between the vehicle and an additive gives a gelatinous look to the ink.	1. Chalking
		2. Livering
		3. Piling
12-63.	Ink is transferred from one sheet to the back of another in the stack.	4. Offsetting
12-64.	Pigment from the ink rubs off the sheet.	
12-65.	The ink fails to transfer from the blanket to the paper.	

12-66. The problem of small, doughnut-shaped spots in the image areas of halftones caused by specks of dirt, are called
1. smudging
2. mottling
3. filling-in
4. hickies

12-67. All of the following are problems caused by too much ink except
1. mottling
2. surface scratch
3. scum
4. plate wear

12-68. Too little drier in the ink may result in all of the following conditions except
1. embossing
2. offset
3. smudging
4. chalking

In items 12-69 through 12-72, select from column B the problem for which the remedy in column A may be correct.

	A. Remedies	B. Problems
12-69.	Slowing down the press	1. Crystallization
12-70.	Cleaning the rollers thoroughly	2. Misting
		3. Glazing
12-71.	Substituting paste drier for cobalt drier	4. Show-through
12-72.	Replacing the paper or using an ink thinned with No. 0 or 00 varnish	

Assignment 13

Bindery Equipment; Letterpress Printing

Textbook NAVEDTRA 10452-C: Pages 422-471

Learning Objective: Recognize bindery operations and the safety precautions that should be observed with bindery equipment.

13-1. What factor determines the number of operations that should be performed in the bindery?
1. The size of the job
2. The type of the job
3. The availability of material
4. The time needed to process the job

● Judge items 13-2 through 13-4 as True or False.

13-2. It is permissible to partially disassemble printing equipment if, by doing so, the amount of time needed to complete a printing job will be reduced.

13-3. You must stop all printing and bindery equipment before you lubricate them.

13-4. When a piece of equipment becomes jammed, you must move the control lever to neutral before you attempt to clear the machine.

Learning Objective: Determine the characteristics, types, and operating procedures to follow with different paper cutting machines.

13-5. What is meant by the term "paper lift?"
1. A device used to raise a quantity of paper
2. An air operated device used to feed paper from the stack to the printer
3. A stack of paper
4. An area where paper is stored

13- 6. Why do many operators of hand cutters top the stack of paper with a piece of cardboard before cutting?
1. To prevent the sheets from slipping
2. To save wear on the knife edge
3. To equalize knife pressure
4. To prevent the clamp from creasing the sheets

13- 7. The edges of a lift of small sheets of paper are evened up through the process of
1. jogging
2. stacking
3. gaging
4. guiding

13- 8. Riffling helps you to slide the lift easily against the side and back gage of the cutter because it
1. introduces air between the sheets
2. squares up the corners of the sheets
3. bends all sheets in the same direction
4. discharges static electricity in the stack

13- 9. When you load books and pamphlets onto the cutter for the first trimming, you place them with the
1. right side against the back gage
2. bound edge against the back gage
3. foot against the back gage
4. top edge against the back gage

13-10. To trim a stack of books, you would follow all of the procedures below except
1. using book guides to prevent slippage
2. flopping over the top half of the stack after making the face cut
3. resetting the back gage settings for the head and foot cuts
4. stacking the books with all backbones on the same side before removing them from the cutter

● Study Hint: Drawing a rough diagram is helpful in figuring out advantageous paper cutting.

13-11. How many 22 1/2 inch by 28 [illegible]2 inch stock sheets are needed to cut 1,000 4-inch by 6-inch pieces without spoilage?
1. 30
2. 40
3. 50
4. 60

13-12. About how many sheets are normally allowed for spoilage in a run of 20,000 sheets on the cutting machine?
1. 50
2. 100
3. 200
4. 400

13-13. What is the most frequent cause of damage to a paper cutter?
1. Trying to cut too thick a lift
2. Allowing the cutting blade to get dull
3. Failing to keep the cutter free of dirt and rust
4. Trying to cut heavy cardboard

Learning Objective: Determine the operating characteristics and the maintenance and adjustment procedures for different types of folding machines.

13-14. What essential components do all folding machines contain?
1. Two or more folding units
2. A feeder
3. A knife
4. All of the above

13-15. The initial forward movement of stock into a friction feeder is produced by
1. gravity
2. rollers
3. air blast
4. suction

13-16. What is the function of the caliper that is mounted on a pile feeder?
1. Measuring the thickness of the stock
2. Forcing the paper from the pile and under the roller
3. Preventing more than one sheet at a time from flowing under the rollers
4. Regulating the height of the stack

● Items 13-17 through 13-19 pertain to loading a continuous feeder. Judge each item as True or False.

13-17. You must stop the feeder to load it.

13-18. The signatures must be loaded upside down.

13-19. The sheets should be fanned out before starting the feeder to facilitate separation.

13-20. If the pressure on the folding rollers is uneven from end to end, the sheets will probably
1. be chewed to ribbons
2. be folded crookedly
3. fail to feed through the machine
4. fail to feed into the fold plates

13-21. When you need to process a single fold on a multi-fold machine, you must
1. remove the extra fold plates
2. disconnect the extra folding units
3. use deflectors on the extra fold plates
4. suspend the pressure of the extra folding rollers

13-22. The function of cross-carrier rollers is to
1. compensate for diagonal feeding
2. position the paper for right angle folding
3. align the paper against the left side guide
4. deflect folded stock onto the stacker

13-23. What adjustments must the operator of a Challenge folder learn to make to the machine?
1. Adjusting for very thin or heavy stocks
2. Setting up for punch perforating
3. Setting up for a single fold
4. All of the above

Learning Objective: Recognize the procedures involved and the equipment used in the final steps of binding.

13-24. What term is applied to the procedure in which a number of pages are collected and put into the proper order?
1. Assembling
2. Collating
3. Sequencing
4. Gathering

13-25. After the pages of a multipage job have been put into the proper sequence, the procedure in which the assemblies or signatures are checked for sequence accuracy is called
1. collating
2. checking
3. sequencing
4. stacking

13-26. After all of the several signatures of a book have been folded, they must next be
1. gathered
2. collated
3. stitched
4. trimmed

13-27. You are making up pads of an office form that comes in triplicate. How many sets will you normally assemble for each pad?
1. 10
2. 25
3. 40
4. 50

13-28. One purpose of printing a collating mark in the gutter is to speed the process of checking the
1. gathering
2. collating
3. trimming
4. binding

13-29. Cheesecloth or gauze would most likely be used in which of the following bindery operations?
1. Stapling
2. Padding
3. Collating
4. Stitching

13-30. Unlike the foot stapler, the wire stitcher has provision for adjustments of the
1. metal tape position
2. staple size
3. table position
4. cutter size

13-31. Which binding method will you be most likely to use in a busy naval printing shop?
1. Wire stitching
2. Foot stapling
3. Spiral binding
4. Plastic binding

Judge items 13-32 and 13-33 as True or False.

13-32. You would use a hand punch to put V-shaped slots in cover stock.

13-33. The simplest way to punch holes in the edge of a few sheets of paper is to use a hand punch.

13-34. Letterheads are usually packaged in quantities of
1. 50 sheets
2. 100 sheets
3. 250 sheets
4. 500 sheets

13-35. You should use all of the following procedures when you wrap or package letterheads and forms except
1. banding loose cards with a strip of paper fastened with water tape
2. wrapping loose paper and forms, usually in lots of 500
3. marking packages for storing to indicate the contents
4. wrapping and taping boxes of envelopes and cards

Learning Objective: Determine the procedures and functions of the equipment used in letterpress printing.

In items 13-36 through 13-39, select from column B the printing device which is described in column A.

	A. Definition	B. Printing Device
13-36.	A metal frame for positioning set type	1. Stick
13-37.	A thin line-spacing metal strip	2. Case
13-38.	A hand-held metal device in which type is arranged	3. Chase
13-39.	A drawer-like container with compartments for type	4. Lead

13-40. After setting type in a stick, you place it next in a
1. chase
2. proof press
3. galley
4. case

13-41. Lowercase letters are arranged in the California job case according to
1. size
2. frequency of use
3. the alphabet
4. typewriter order

13-42. In what section of the California job case is the capital letter "E" placed?
1. Left, near the top
2. Right, near the top
3. Center, near the bottom
4. Left, near the bottom

13-43. What is the first thing inserted in the three-sided metal stick used by the compositor?
1. A slug
2. A lead
3. A space unit
4. An em quad space unit

13-44. How do you arrange type letters to form words as you insert them in the stick?
1. Left to right, nicks in
2. Left to right, nicks out
3. Right to left, nicks in
4. Right to left, nicks out

13-45. What space unit is generally used between the sentence in a paragraph?
1. Quad
2. 1-em space
3. 2-em space
4. 3-em space

13-46. If there is not enough space to get all of the last word in the line, you could try to respace with
1. 5-em spaces
2. 3-em spaces
3. nut spaces
4. em quads

13-47. When the line is too short, you should try to respace it out to the full width of the stick by replacing the 3-em spaces between the words with
1. em quad
2. 4-em spaces
3. 5-em spaces
4. nut spaces

13-48. If all of the following spaces are used in a line of type, which space should be kept closest to the type?
1. Thin space
2. 3-em space
3. Nut space
4. Em space

13-49. What is the least amount of space usually allowed between the border and the type?
1. 4 points
2. 5 points
3. 6 points
4. 7 points

13-50. LI2 Green discovered several errors in a proof and after he corrected them, he found that a line was too short. He should then respace the line in the
1. galley
2. chase
3. stick
4. case

13-51. Which of the following substances can be used to make certain that all of the letters of a transparent proof are completely opaque?
1. Wax
2. Powdered bronze
3. Ink extender
4. Gelatin

13-52. Which step in distributing the type from a dead form is taken first?
1. Determining which case the type came from
2. Cleaning the type
3. Placing the galley on the work bank
4. Transferring the type to a galley

13-53. You can more easily observe the printing run when the top of the form is locked in the press either to the
1. left or bottom
2. left or top
3. right or bottom
4. right or top

13-54. When you are locking a form, where should you place the longest furniture?
1. Near the edge of the form
2. Far from the head of the form
3. Near the edge of the chase
4. Far from the edge of the chase

13-55. When you are locking a form, point the quoins so that the squeeze is directed toward the solid corners of the chase. Then lock the bottom and side quoins by turning the key

1. clockwise
2. counterclockwise
3. clockwise and counterclockwise, respectively
4. counterclockwise and clockwise, respectively

Learning Objective: Recognize how to set up, operate, and adjust hand-fed platen presses and automatic feeder presses.

13-56. What type of press is commonly used for letterpress printing in the Navy?

1. Cylinder
2. Rotary
3. Platen
4. Web

Items 13-57 through 13-58 deal with the parts and operation of open platen presses.

13-57. The function of the throwoff lever on the open platen press is to cause the press to

1. operate automatically
2. print two or more forms simultaneously
3. cease printing
4. operate at full speed

13-58. The function of the saddles on a platen press is to hold the

1. disk
2. crankshaft
3. rollers
4. trucks

13-59. What parts of the platen press are used as guides for registering the paper?

1. Rollers
2. Grippers
3. Gage pins
4. Trucks

13-60. Where is ink added by hand on a platen press during a run?

1. Upper right edge of the disk
2. Lower left edge of the disk
3. Center of the disk
4. Ink rollers

13-61. If a press proof indicates that the margins of the sheet need straightening, you should adjust the position of the

1. tympan
2. grippers
3. delivery arm
4. gage pins

13-62. The width of the form is ten inches and the width of the sheet is fourteen inches. Therefore, the bottom margin of the form, when centered, should be approximately

1. 1 in.
2. 2 in.
3. 3 in.
4. 4 in.

13-63. How many gage pins do you normally use on the left margin of the drawsheet?

1. One
2. Two
3. Three
4. Four

13-64. To which of the following positions should the grippers on the platen press be moved while you are taking the first steps to set up a job?

1. Nearest to the type
2. Away from the edges of the platen
3. At the far edges of the platen
4. At the margins of the sheet

13-65. What should you use to correct an uneven impression that is caused by low type?

1. Additional ink on the rollers
2. Less packing under the drawsheet
3. A small piece of wet paper under the low type
4. Additional grippers

13-66. When you are feeding a platen press, what step should you take to prevent smearing the ink?

1. Wear a rubber finger
2. Put glycerine on your fingers
3. Wear a sandpaper stall on your finger
4. Put talcum powder on your fingers

13-67. What is the purpose of the throwoff lever on the open platen press?

1. To act as a safety device to prevent the press from making an impression
2. To regulate the quantity of ink that is applied to the type
3. To regulate the printing pressure of the press according to the thickness of the paper
4. To adjust the eveness of the impression

13-68. You should use caution when operating a platen press on board ship in heavy weather because the
1. feeding rhythm is affected
2. impression will be uneven
3. gage pins may slip
4. platen regulating nuts may loosen

13-69. To prevent damaging the rollers on a platen press, which of the following actions should you take when perforating or running a rule form?
1. Remove the rollers
2. Use old rollers
3. Do either 1 or 2 above
4. Use metal or summer rollers

13-70. Where is the delivery table of the Kluge automatic press located in relation to the feeding unit?
1. Below
2. Above
3. To the right
4. To the left

13-71. Which of the following mechanisms of the Kluge press lifts each sheet of paper and moves it forward against the bottom gage pins of the platen?
1. The delivery arm
2. The feed arm
3. The air control lever
4. The sheet holder tongue

13-72. Which of the following operations should you perform on the Kluge press before you begin your makeready operations?
1. Removing the magazine
2. Releasing the clutch
3. Raising the feeding and delivery arms
4. Locking the magazine latch

13-73. Which of the following statements describes the action of the delivery table on the Kluge automatic press?
1. It remains stationary
2. It lowers automatically but must be adjusted for thickness of stock
3. It lowers automatically and is self-adjusting for thickness of stock
4. It is lowered by the pressman who must adjust it for thickness of stock

Assignment 14

Letterpress Printing (Continued); Shop Administration

Textbook NAVEDTRA 10452-C: Pages 471-504

Learning Objective: Determine the characteristics and uses of letterpress cuts and some of the recent developments in letterpress printing.

14-1. After you develop the negative in the photoengraving process, what do you do next?
1. Mount it on glass
2. Sprinkle it with "dragon's blood"
3. Apply heat
4. Peel the emulsion from the film

14-2. What substance is used to make a stereotype cut from a mat?
1. Paper
2. Plastic
3. Rubber
4. Metal

14-3. After slugs have been cast on typesetting machines, they are assembled on
1. sticks and proofed
2. cases and proofed
3. galleys and proofed
4. presses and proofed

14-4. Which of the following machines is used to cast lines of individual letters rather than slugs?
1. Linotype
2. Ludlow
3. Monotype
4. Intertype

14-5. Whereas the Intertype uses molds to produce characters, the Fotosetter uses
1. disks
2. punched tape
3. magnetic tape
4. photographic matrixes

14-6. How many 90-character fonts are contained on the disk of the Photon?
1. One
2. Five
3. Sixteen
4. Seventy-two

14-7. Optimum use of the speed of a computer is made possible by new typesetting machines that use a
1. tetrode tube
2. beam power tube
3. triode tube
4. cathode ray tube

14-8. Which of the following factors tends to prevent the smaller printing company from using the new optical typesetting machines?
1. Cost
2. Size
3. Weight
4. All of the above

Learning Objective: Recognize the administrative and management duties that may be required of the Lithographer 3&2.

14-9. The basic rules and regulations that cover all printing done by the Federal Government is formulated by
1. the President
2. a Congressional Committee
3. the Government Printing Office
4. the Bureau of Printing and Engraving

14-10. The Department of the Navy Publications and Printing Regulations differs from the Government Printing and Binding Regulations in that the former describes
1. all printing services that are provided by printing activities throughout the naval establishment
2. printing requirements for specific naval activities
3. specific policies and regulations that apply only to the Navy
4. all publications that are used in the Department of the Navy

14-11. Which of the following forms of direction is exercised by the Navy Publications and Printing Service (NPPS) over the Navy's printing facilities?
1. Administrative
2. Personnel
3. Operational
4. Technical

14-12. What is the purpose of the Shipboard Inventory Report?
1. To provide information on the status of the ship's printing equipment
2. To serve as justification for the purchase or disposal of equipment
3. To report annual printing needs of the ship
4. To report the cost of printing services performed aboard each ship

14-13. Which instruction sets forth the security requirements for safeguarding classified material?
1. OPNAVINST 4610.3 series
2. SECNAVINST 4810.5 series
3. OPNAVINST 5510.1 series
4. NAVSUPINST 5600.16 series

Learning Objective: Determine the security requirements of classified material, the security clearance of personnel, and the destruction of classified material.

In items 14-14 through 14-17, select from column B the security term that is defined in column A.

	A. Definitions	B. Terms
14-14.	The ability to gain knowledge or possession of classified information	1. Clearance
14-15.	An administrative determination for eligibility of access to security information	2. Compromise
14-16.	An incident in which an unauthorized person gains access to classified information	3. Access
14-17.	An official release of classified information to a specific group or activity	4. Disclosure

14-18. In addition to the requirement that a person have the appropriate clearance to be trustworthy, what other conditions are needed to establish "need to know"?
1. A determination that disclosure is in the interest of national security
2. A requirement that disclosure is needed to perform assigned duties
3. A determination that no other source of the information is available
4. All of the above are needed

14-19. Which of the following terms is applied to an area that a person may enter only when he has the proper security clearance and his duties require that he have access to the classified material contained in the area?
1. Limited area
2. Security area
3. Controlled area
4. Exclusion area

14-20. Which area is located between the unrestricted area and the area that contains classified information?
1. Exclusion area
2. Limited area
3. Controlled area
4. Security area

14-21. What security classification is given to defense information which may cause serious damage to the nation if the information is disclosed?
1. Top Secret
2. Secret
3. Confidential
4. For Official Use Only

14-22. What security label is used for the protection of information for the good of the nation rather than in the interest of national defense?
1. Top Secret
2. Secret
3. Confidential
4. For Official Use Only

14-23. Various parts of a DOD document contains Top Secret, Secret, Confidential, and Unclassified information. What security label must be placed on the entire document?
1. Top Secret
2. Secret
3. Confidential
4. Unclassified

14-24. When you secure a safe that has a dial combination lock, how many complete turns in the same direction should you rotate the dial?
1. Two
2. Three
3. Four
4. Five

14-25. What should you do to safeguard the classified material you have been using at your desk if you have to leave the area even for a moment?
1. Inform your supervisor that you are leaving classified material at your desk
2. Put the material out of sight in a drawer or other place
3. Lock the material in the safe
4. Give the material to one of the office personnel

14-26. An emergency plan is formulated aboard ships or ashore to safeguard material during
1. floods and fire
2. hostile enemy action
3. civil riots
4. all of the above

14-27. Which qualifications must be determined by the investigation that is conducted on a person's past to permit him access to classified material?
1. Loyalty to the United States
2. Excellence of character
3. Unquestionable integrity
4. Each of the above

14-28. Which term correctly designates a determination of temporary eligibility for access to classified information?
1. Interim clearance
2. Initial clearance
3. Temporary clearance
4. NAC clearance

14-29. How should classified publications be destroyed aboard ship during an emergency?
1. By burning if the ship is in shallow water; by jettisoning if the ship is in deep water
2. By jettisoning if the ship is in shallow water; by buring if the ship is in deep water
3. By burning whether the ship is in deep or shallow water
4. By jettisoning whether the ship is in deep or shallow water

14-30. For which of the following categories of classified documents is a record of destruction required?
1. Top Secret only
2. Secret and Top Secret
3. Secret and Confidential
4. All categories of classified material

Learning Objective: Recognize the printing restrictions, paper work, and supply duties that are required in the printing shop.

14-31. Under what condition may paper money be reproduced?
1. The reproduction will be used for educational purposes
2. The printed material in which the reproduction appears will not be sold in the United States
3. The use specifies that the reproduction must be the exact size and color of the original article
4. The person who reproduces the article swears that the printed material will not be used for unlawful purposes

14-32. For what maximum length of time may printed material be copyrighted?
1. 7 years
2. 28 years
3. 35 years
4. 56 years

14-33. What factor determines whether or not Government publications are in the public domain?
1. The number of reproduced copies of the publication
2. The copyrighted material that the publication contains
3. The length of time that the document will be in effect
4. The eligibility of sale of the publication outside of the United States

14-34. The copyright covers all of the original material in a book except
1. body
2. title
3. appendixes
4. illustrations

14-35. Which of the following methods may you use to keep a record of the printing jobs that are done in your shop?
1. Control card
2. Scheduling board
3. Control ledger
4. Each of the above may be used

14-36. You have received a printing request for Armed Forces Day programs. The request specifies the size, quantity, ink color, stock, typography, and the illustrations to be used. What additional information, if any, should you obtain from the originator of the request?
1. Date required
2. Priority of the request
3. Serial number of the printing request
4. None, since the request is detailed enough

14-37. You receive a printing requisition and note that the completion date specified on it has already passed. What action whould you take?
1. Send the requisition back to the ordering activity with a request for new instructions
2. Fulfill the request after all previously received work is completed
3. Let your printing officer or the ordering activity know when the job will be finished
4. Get the printing officer to assign a priority to the job so the ordering activity will be satisfied

14-38. You will store some or all of the lithographic and photographic supplies in the shop. Good storage management requires you to ensure that
1. packaged supplies are marked as to content
2. items in daily use are readily accessible
3. materials are grouped according to similarity
4. all of the above practices are observed

14-39. Which of the following methods should you use in the print shop to ensure that all necessary supplies are kept in stock at all times?
1. A running inventory
2. A physical check
3. A high and low stock level
4. A quarterly scheduling inventory

14-40. Assume that your ship is at sea and will arrive at a shore activity in three days. You desire to order some printing supplies from the local supply activity and prepare the requisitions prior to the ship's arrival. You do this primarily to
1. get ahead of other personnel ordering supplies
2. avoid having to submit the requisitions through your ship's supply office
3. obtain lower prices for your supplies
4. allow the local supply activity as much time as possible to fill your order

14-41. Which of the following forms should you submit to the supply office when you need material from the ship's storeroom or from an outside source?
1. NAVSUP Form 1250
2. NAVSUP Form 302
3. Standard Form 1165
4. DD Form 1348

14-42. You have a defective printing press and the required repair part is not listed in the ship's COSAL. What action should you initiate to ensure that the print shop will be capable of full production in the shortest time possible?
1. Order a new press on DD Form 1348
2. Submit a DD Form 1348/6 that contains information from the manufacturer's catalog and a DD Form 1348 to the supply office
3. Give the supply office a good description of the part from your own observation, and leave further identification to the supply personnel
4. Send the defective part to the manufacturer with an order for a new part

---

Learning Objective: Recognize the duties of the Lithographer in determining shop layout, quality of work, and job estimating in the printing shop.

14-43. Which consideration, in addition to space limitations, must take precedence over the others in determining the layout of a shipboard print shop?

1. Convenience of the equipment
2. Operational sequence through the shop
3. Motion of the ship
4. Location and type of electrical power available

14-44. Which of the following areas of a well designed print shop ashore should be located nearest to the office?

1. Copy preparation room
2. Stripping room
3. Stock storage room
4. Pressroom

14-45. If possible, which areas of the shop should have large doors?

1. Plate room and stripping room
2. Bindery and pressroom
3. Camera room and bindery
4. Copy preparation room and plate room

14-46. Which of the following print shop equipment should be grouped together in the same room?

1. Bindery and camera
2. Platen press and paper cutter
3. Platemaking and platen press
4. Letterpress and hand type

14-47. Which of the following advantages is/are gained by working up jobs to the sheet size of the smallest press in your shop?

1. Reduced press time
2. Improved flexibility of scheduling
3. Reduced folding and cutting
4. All of the above

14-48. The factors which you must consider in arriving at the most economical method of producing a given job include the costs of using different

1. types of supplies
2. preparation methods
3. reproduction equipment
4. types of supplies, preparation methods, and reproduction equipment

In items 14-49 through 14-56 you are the Leading Lithographer in a shore station print shop that has offset and letterpress equipment.

14-49. A requester wishes to know approximately how much time will be required to finish his job request. The first factor you should consider in making the time estimate is the

1. make ready time for the presses
2. skill and efficiency of your personnel
3. printing process to be used
4. availability of supplies and chemicals

14-50. If the time estimated for making line negatives without filters is 80 minutes, how much time should you estimate for the same job when filters are to be used?

1. 1 hr, 40 min
2. 2 hr
3. 2 hr, 40 min
4. 4 hr

14-51. After you make a time estimate on a job for which you have planned to use a wipe-on plate, you discover that you have a presensitized plate in stock. To use the presensitized plate, you should revise your time estimate by

1. subtracting 10 min
2. adding 10 min
3. subtracting 15 min
4. adding 15 min

14-52. Assume that you are to print 6,000 impressions of single-color line work on an off-set press. What is the approximate press running time for this job?

1. 1 1/2 hr
2. 2 hr
3. 2 1/2 hr
4. 3 hr

14-53. You assign two men to perform the gathering necessary for a printing request for 15,000 pamphlets, each having one insert. Allowing for unforseen delays, what is a reasonable time estimate for the gathering operations?

1. 5 1/2 hr
2. 6 1/4 hr
3. 7 1/2 hr
4. 8 1/4 hr

14-54. What is the approximate number of impressions that can be run in one day on a large offset press, when the run for each plate is 2,000 copies?

1. 5,000
2. 15,000
3. 20,000
4. 25,000

14-55. What is the most time that you should allow for estimating, scheduling, and writing up a job jacket for 5,000 letterheads to be printed by letterpress?

1. 10 min
2. 20 min
3. 30 min
4. 60 min

14-56. Approximately how many impressions should you expect an operator to turn out in a four-hour run of the hand-fed press?

1. 4,000
2. 8,000
3. 10,000
4. 16,000

Learning Objective: Determine training requirements and procedures for the personnel in the printing shop.

14-57. You should always start a man's training on unfamiliar processes or equipment by discussing the subject of
1. setup procedures
2. safety practices
3. scheduling methods
4. advancement opportunities

14-58. Your shop will operate most efficiently and be best prepared for operating emergencies if each man is trained to
1. operate any one or two machines expertly
2. operate all or most of the equipment in the shop
3. specialize in camera work and platemaking
4. concentrate on offset rather than letterpress processes

14-59. Which of the following practices should you adopt in order to improve training in your shop?
1. Teach the common short cuts in an operation from the beginning so that your men will not need to relearn the job later
2. Follow technical training on each job with a discussion of related safety practices
3. Teach each job as a single operation instead of breaking it up into small units
4. Back up your practical applications with discussions of the theory behind them

14-60. Assume that you have explained the operation of a machine to a trainee and run through the operation several times as he watched. As he tries the operation for the first time, he makes a mistake on an early step. He seems unaware of the error and begins the next step. How should you correct his improper procedure?
1. Let him go ahead until he discovers the mistake and then let him decide where the error was and correct it
2. Take over as soon as he makes the error and complete the rest of the operation as he watches
3. Point out the mistake immediately and tell him how to correct it
4. Say nothing about the mistake until he finishes and then point out the effect on the finished job and tell him what went wrong

14-61. You will improve morale and help the men under your direction to feel more confident and secure if you
1. encourage them to enjoy printing as a hobby
2. display consistent expectations of them in their work
3. provide a study library in the shop for use during working hours
4. set a fixed maximum of work expected of them daily

14-62. How should you handle a man who is not doing his share of work in the shop?
1. Take away all of his privileges
2. Criticize him before the entire shop
3. Transfer him to another job in the shop
4. Assign him a specific amount of work to complete daily

☆U.S. GOVERNMENT PRINTING OFFICE: 1975-640-700/70

IN THE EVENT OF DISENROLLMENT, all study materials must be returned. To insure that you are credited with the return of these materials, fill out this form and attach it to the inside front cover of the basic text before mailing it to the Center.

PRINT CLEARLY

NAVEDTRA Number

NAVEDTRA 10452-C

COURSE TITLE

LITHOGRAPHER 3 & 2

Name Last First Middle

Rank/Rate Designator Social Security Number

Active duty personnel do not receive completion letters as their courses are administered by local commands. All other personnel, having courses administered by the Center, complete the below information to receive their completion letters. Give complete mailing address.

NAME

ZIP CODE:

MY SERVICE RECORD IS HELD BY: (Give complete mailing address)

Activity

Address ZIP CODE

Signature of Enrollee

A FINAL QUESTION: What did you think of this course? Of the text material used with the course? Comments and recommendations received from enrollees have been a major source of course improvement. You and your command are urged to submit your constructive criticisms and your recommendations. This tear-our form letter is provided for your convenience. Typewrite if possible, but legible handwriting is acceptable.

Date__________________________

From: __________________________________

____

__________________________________ZIP CODE________________

To: Commanding Officer, Naval Education and Training Program Development Center
Pensacola, FL 32559

Subj: Comments on nonresident career course and/or texts

1. The following comments are hereby submitted on course and text material of NRCC Lithographer 3&2, NAVEDTRA 10452-C.

(Continue on separate sheet if necessary)

(Fold along dotted line and staple or tape)

....

(Fold along dotted line and staple or tape)

....

DEPARTMENT OF THE NAVY

NAVAL EDUCATION AND TRAINING PROGRAM
DEVELOPMENT CENTER (PDR 2)
PENSACOLA, FLORIDA 32559

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE NAVY
DOD-316

U.S. MAIL

NAVAL EDUCATION AND TRAINING PROGRAM DEVELOPMENT CENTER (PDR 2)

PENSACOLA, FLORIDA 32559